63-4-2

CLIMATOLOGY
for
McGuire Air Force Base, New Jersey

EASTERN TRANSPORT AIR FORCE

STRATEGIC AIR COMMAND

Con AC

DET 10

15TH WEA SQ

MCGUIRE AIR FORCE BASE

TERMINAL FORECAST REFERENCE FILES

CONTENTS

These files have been revised in accordance with 8WGM 55-1 dated 8 July 1961. They are designed to: (1) provide a written record of local forecasting information, problems and objective solutions to these problem; (2) aquaint new forecasters with an accumulation of experience of this station in abbreviated form; (3) serve as a ready reference for local forecasting techniques and local climatological data.

Prepared 1 May 1962

Detachment 10, 15th Weather Sq
McGuire AFB, New Jersey

Section I Location and Topography

A. Geographic Location

B. Smoke Pollution

C. Instrumentation

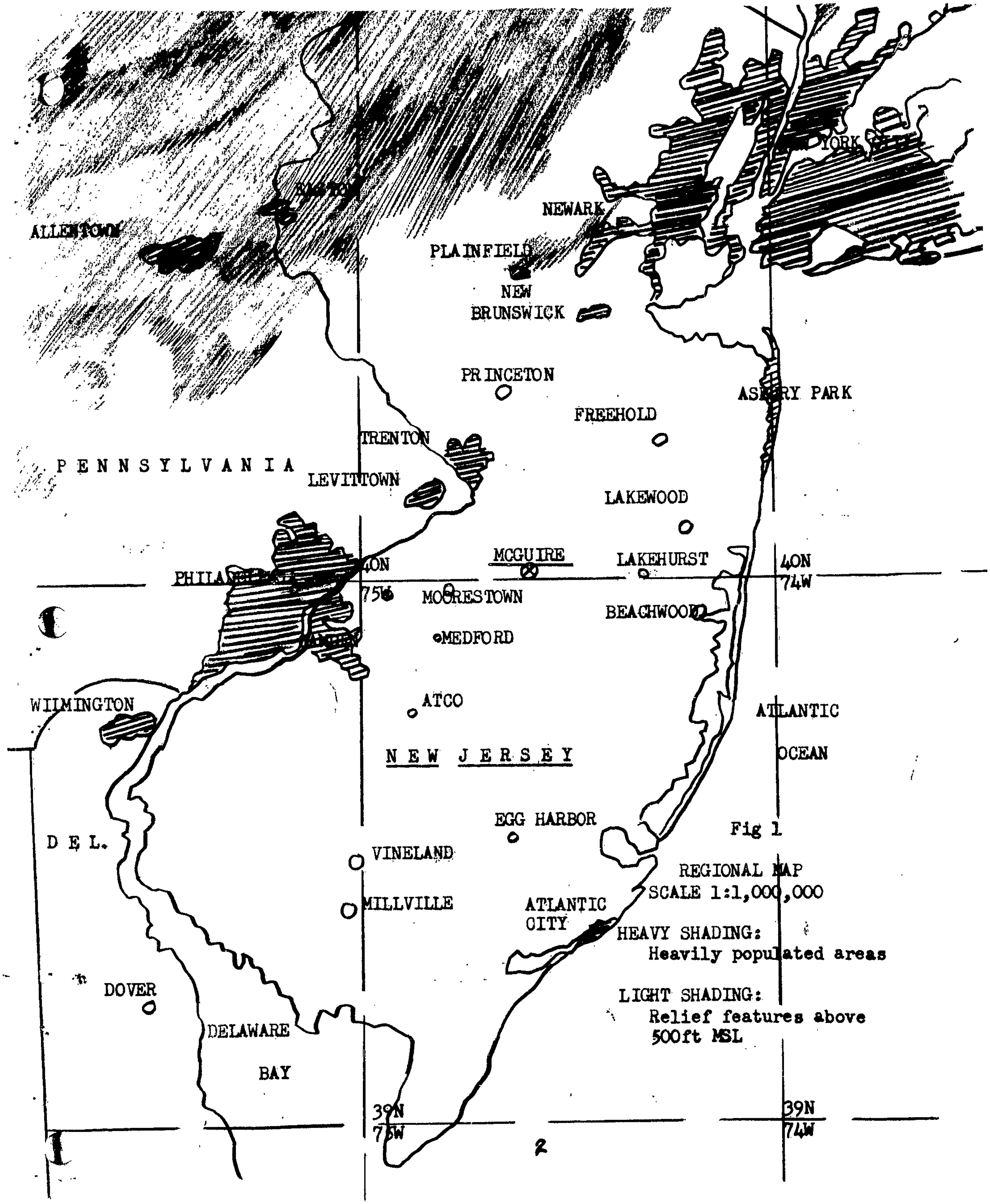
I LOCATION AND TOPOGRAPHY

A. Geographic Location

McGuire Air Force Base is situated at 40°01'N and 74°36'W at an elevation of 131ft above sea level. The station is 16mi southeast of Trenton, New Jersey; 30mi east-northeast of Philadelphia, Pa.; and 15mi west of Lakehurst, New Jersey. See Regional Map, Fig. 1.

The ground coverage in the immediate vicinity consists of approximately 40% open fields and 60% wooded country. The surrounding land areas are relatively flat within 25mi of the station. Beyond 25mi the terrain becomes rolling to the north through southwest, with a marked upslope beyond 75mi to the west through northwest approaching the Appalachian chain. There is a marked downslope effect at McGuire as the air masses move over the mountains from north through southwest.

The Atlantic Ocean lies 30mi east of the station. The Delaware Bay 60mi to the south-southwest and the Chesapeake Bay beyond are the only other major water bodies affecting McGuire's local weather. The effect of the ocean on air circulation is slight. Occasionally in the Tropical air of summer, with a flat pressure gradient, a mild sea breeze will reach the station. Generally, this breeze will be from the southeast. It is probable that the ocean increases the velocity of cold northwest winds in winter.


ALLENTOWN
NEWARK
PLAINFIELD
NEW BRUNSWICK
PRINCETON
FREEHOLD
TRENTON
P E N N S Y L V A N I A
LEVITTOWN
LAKEWOOD
MCGUIRE
LAKEHURST
40N
75W
40N
74W
MOORESTOWN
BEACHWOOD
MEDFORD
ATCO
WILMINGTON
ATLANTIC
OCEAN
N E W J E R S E Y
EGG HARBOR
D E L.
VINELAND
MILLVILLE
ATLANTIC CITY
DOVER
DELAWARE
BAY
39N
75W
39N
74W
2
Fig 1
REGIONAL MAP
SCALE 1:1,000,000
HEAVY SHADING:
Heavily populated areas
LIGHT SHADING:
Relief features above
500ft MSL

B. Smoke Pollution

There have been relatively few instances where smoke alone lowered visibilities at McGuire AFB below 1 mile (overall average of 0.5% of total observations with smoke).

The major distant smoke pollution sources are the industrial areas of Trenton, Camden-Philadelphia, and Newark-New York City. Smoke pollution from these problem areas affect the visibilities at McGuire when the wind trajectory is from the NE or NNE for the Newark-New York City areas; and WSE, W and WNW for the Camden-Philadelphia and Trenton areas. (see table below).

Visibility restrictions due to smoke pollution during periods of calm or light surface winds, originate primarily from the coal-fed base central heating plant and occur to the greatest extend during the plant's maximum utilization, i.e., the winter season.

TABLE I

The relation of wind and visibility when smoke is the only restriction to visibility. Period of record: Jul 42-Mar 46 and Aug 48-Aug 62.

SURFACE WIND DIRECTION	TOTAL OBS WITH SMOKE	% OF VSBY LESS THAN 1 MILE	% OF VSBY 1-2 1/2 MILE	% OF VSBY 3-6 MILES
Calm	2050	1.4	16.0	82.7
N	645	0.8	10.5	88.7
NNE	460	1.1	15.4	83.5
NE	375	.5	16.3	83.2
ENE	356	0	9.3	90.7
E	327	.3	6.4	93.3
ESE	269	.4	7.4	92.2
SE	233	.4	9.0	90.6
SSE	245	0	5.7	94.3
S	441	0	6.3	93.7
SSW	711	0	4.2	95.8
SW	1298	.4	7.9	91.7
WSW	1359	.3	13.3	86.4
W	1103	.4	16.0	83.6
WNW	1129	.3	10.0	89.7
NW	683	.4	8.6	90.9
NNW	571	.2	8.6	91.2

C. Instrumentation

McGuire was the second AFB in the USAF to have complete dual weather instrumentation installed. The weather observations taken at McGuire are recorded in a Representative Observation Site (Bldg. 16-17) which is located 1 1/2 miles southwest of the Base Weather Station (Bldg. 17-31). The weather instrumentation provides each end of runway 24-06 with measurements of wind flow, visibility and height of low clouds. In addition a temperature humidity device located northwest of runway 24-06 provides a continual measurement of free air temperature and dewpoint. This hygrothermometer has been modified so as to give accurate reading even during periods of heavy precipitation. A fixed beam ceilometer is presently located near the Representative Observation Site but is programmed for removal. In addition to the above equipment a mercurial barometer, an aneroid barometer and a micro-barograph are located in the ROS. Visibility readings over 2 miles are taken visually from the ROS using check points and reference markers. These check points up to 3 miles from the ROS provide excellent coverage except to the southwest where no good reference points are available due to the proximity of a wooded area on the Fort Dix military reservation. However this quadrant is normally of little operational concern. The control tower personnel also take limited visual observations particularly in reference to visibility and special weather phenomena. When visibility is below two miles the transmissometer equipment is used for primary measurements with visual check points serving as verification. The location of the various instruments are listed below and shown by illustration on figure #1.

INSTRUMENT	SENSOR LOCATION
Rotating Beam Ceilometer (AN/GMQ-13A)	
Detector (Runway 06)	3930ft from end of runway 06 on centerline.
Projector (Runway 06)	400ft NW of detector.
Detector (Runwa, 24)	2500ft from end of runway 24 on centerline.
Projector (Runway 24)	400ft S of detector.
Transmissometer (AN/GMQ-10)	
Detector (Runway 06)	1000ft from end of runway 06 and 550ft from centerline.
Projector (Runway 06)	500ft NE of detector.
Detector (Runway 24)	1000ft from end of runway 24 and 550ft from centerline.
Projector (Runway 24)	500ft NE of detector.
Wind Equipment (AN/GMQ-11)	
Runway 06	500ft SE of end of runway.
Runway 24	500ft S of centerline and 1000ft from approach end of 24.
Hygrothermometer (AN/TMQ-11)	2650ft from end of runway 06 and 1200ft NW of centerline.
Fixed Beam Ceilometer (AN/GMQ-10)	
Detector	8ft from North door of ROS.
Projector	800ft N of detector.
Barometers	
Mecurial, Aneroid, microbarograph	In ROS.
Radar Storm Detector (CPS-9)	
70ft Tower	638ft N of weather station.
Console	Base Weather Station.
Rain Guage (ML-17 8" type)	51ft N of ROS.
Instrument Shelter (ML-41)	42ft N of ROS.

All recorders and indicators are located at the ROS except the CPS-9 in the weather station and additional wind indicators which are located in RAPCON and the control tower. The switch selector for wind equipment is located in the control tower while the switch selectors for the ceilometers and transmissometers are located in the ROS.

WEATHER INSTRUMENTATION

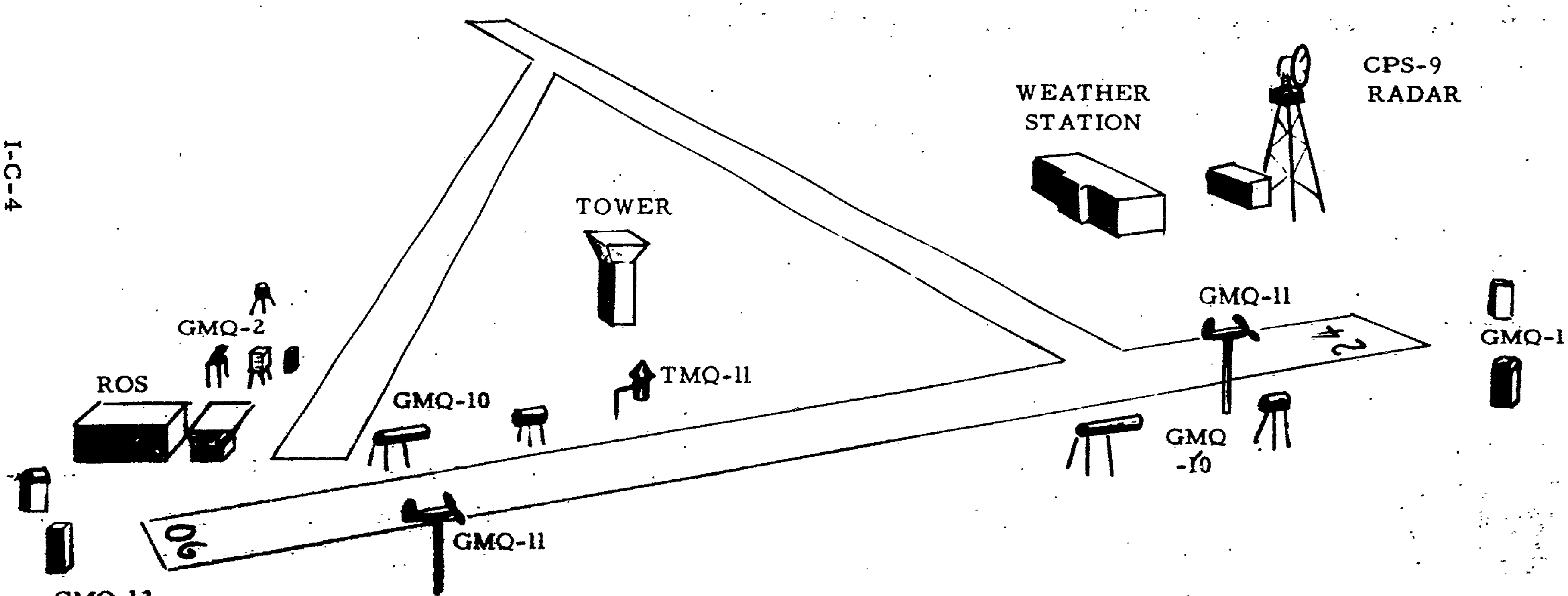


FIGURE 1

SECTION II WEATHER CONTROLS

A. GENERAL CLIMATOLOGY

B. AIR MASSES

C. FRONTS

A. General Climatology.

The winter weather at McGuire can be explained by the migratory cyclones and polar anticycl :es that traverse the east coast. With the prevailing off shore circulation the mean winter temperatures are quite low (compared to Western or Southeastern U. S.).

Throughout the summer, high temperatures predominate; however, there are periodic invasions of cool air, either from the Hudson Bay or from the Atlantic Ocean.

There is .o prounounced maximum or minimum precipitation. Winter precipitation can be attributed to cyclonic activity; the heaviest falls occur with low pressure systems that develop in the south and subsequently follow a northeasterly path. Eastward moving cyclones from the Alberta region also contributed to McGuire's precipitation. In summer, the rainfall is mainly a result of convective showers and thunderstorms although cyclonic activity still occurs. Occasional hurricanes effect the McGuire area in late summ :r and early fall.

In the most simplified analysis, there are but two major weather systems controlling the weather at McGuire: the CP high pressure from Canada which prevails during the winter in contrast to the MT high pressure centered near Bermuda which dominates in summer. The interaction migration or dominance of these two cells in the final analysis determines the daily weather conditions at McGuire. Typical synoptic types and the associated weather are illustrated in Section IV (Special Synoptic Studies).

B. Air Masses

Maritime Tropical air is first found on the surface in March for one or two days. The frequency gradually increases to seven to nine days per month during mid-simmer and early fall, and then gradually decreases to one day per month by December.

Maritime Polar air appears eight to twelve days per month throughout the year with a slight decrease in frequency from September to February.

Continental Polar air or some modified form of it appears over the station for the remainder of the time and is therefore the dominant air mass at McGuire.

Frontal systems approaching from the northwest and with northwesterly winds aloft, give little bad weather. Field conditions will usually remain contact except for brief periods during the frontal passage. But, systems approaching from the southwest with southwest winds aloft, give instrument to closed conditions. This is due not only to the relative dryness of the air masses approaching from the west, but also to the protective mountain range extending northeast to southwest through Pennsylvania and northern New Jersey. Any air mass approaching this station from a direction between north-northwest and west-southwest will experience adiabatic heating by a descent of 2000 to 3000 feet, a feature that greatly influences the weather on the coastal plain. The lake effect, causing cloudiness and precipitation to the lee side of the Great Lakes southeastward into Pennsylvania is absent at this station.

McGuire AFB has the typical Middle Atlantic Coastal Plain type climate, receiving the largest part of its bad weather in maritime air masses coming from the Atlantic to the east or from the Gulf of Mexico and South Atlantic. The maximum frequency of low ceilings below 1000 feet occurs in January, 13.5% of the time. September and May follow with 13% and 12% respectively. The best ceilings are in June, July, August and November when ceilings are 1000 feet and above 90% to 92% of the time. January also has the highest percentage of low visibilities being below 3 miles 19% of the time. The best visibilities are in June, July, August and November when visibilities are above 3 miles 87% of the time. Source: McGuire Summary, Part A, 12 year period, Aug 42-Mar 46, Aug 48 - Aug 56.

C. Frontal Systems

From Table I below it can be seen that cold fronts are the most common type of front passing this station in all seasons. It is also significant that the total number of frontal passages is greatly reduced in summer. For example, there are 12 passages in February and only 7 in August.

TABLE I

FREQUENCY OF FRONTAL PASSAGES BY MONTH

Source: Historical Weather Maps, 5 Year Period

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
COLD	4.0	5.7	5.4	3.7	5.8	5.2	5.7	4.8	3.6	5.2	5.9	5.5
WARM	2.4	4.3	5.0	2.0	2.8	2.3	2.5	1.8	3.0	1.8	4.7	2.8
OCCLUDED	2.7	2.0	1.3	1.7	0.2	0.8	0.2	0.8	1.3	2.3	2.1	1.8

Frontal systems move much faster in the winter than in the summer; therefore, the air masses change more frequently in the winter than in the summer. Although the frontal systems move more slowly in the summer, the periods of bad weather associated with them are usually shorter than during other seasons.

The Allegheny Mountains to the west and northwest provide the only important topographical effect on climate and weather at this station. In the winter, spring and fall this effect is most pronounced. Air masses moving across the mountains from the west to the east are considerably warmed in the lower levels. Precipitation from cold fronts or continental polar air masses west of the mountains seldom reaches this station except as very light showers or squalls. Occasionally, a cold front moving slowly across the mountains will intensify on the lee side with a south to southwest gradient wind ahead of the front causing precipitation and low ceilings for an hour or two. Normally, the gradient wind east of the mountains ahead of a cold front will veer to the west or northwest before the front arrives. Because of the general low pressure area to the northeast during the greater part of the winter, the winds are largely from the west or northwest, more so than to the west of the mountains. With such winds, very little precipitation occurs and practically no low ceilings or visibilities except with an occasional squall associated with the passage of an active cold front. In the summer, cold fronts act much like those in the winter. One exception is the occasional line of thunderstorms which appears along the front in the afternoon, yielding heavy precipitation, usually in scattered areas. Tropical air masses with thunderstorms seldom extend this far east with a west-southwest to northwest gradient wind.

In all seasons, though more often in the colder months, cold fronts are usually preceded by more precipitation than is in the front itself, unless there is wave action in the vicinity. The actual frontal passage will be dry with only scattered to broken clouds present followed by clearing within 1 to 2 hours after the passage.

Cold fronts in winter, spring and fall associated with a deep low south of Hudson Bay and north of the Mohawk Valley are invariably very dry with strong, gusty surface winds following the passage. The cold air behind these fronts is generally very unstable and turbulent because of the high winds blowing across the mountains from the Great Lakes.

During the day, with the added influence of heating, a strato-cumulus layer develops which may give light showers or squalls. Wind shifts are very gradual with the passage of fast moving cold fronts.

SECTION III CLIMATIC AIDS

A. ANNUAL

B. WINTER

C. SPRING

D. SUMMER

E. FALL

CONTENTS

PREFACE

Weather information for planning purposes generally falls into four categories: Climatic Data; Long-range Outlooks; Extended Forecasts; Short-range Forecasts. The information presented here is climatic data and should be applied in the same manner as other forms of statistical information. These data represent the average weather conditions and are computed from at least ten years of weather records.

If and when you have need for climatic assistance, it is particularly important that you exercise caution when interpreting the following statistics. As an example, two separate terminals may have the same average monthly rainfall amounts, yet one receives its precipitation in the form of brief showers and the other in the form of steady drizzle.

In order to insure that all related factors are considered, it is strongly recommended that a meteorologist be consulted when applying these data. More detailed climatic information for McGuire (including persistence probabilities) is on file in the weather station. These data together with our consultant services are available upon request.

The following climatic statistics are based on records from August 1942 through March 1946, and August 1948 through August 1956.

Guire AFB, New Jersey

ABBREVIATED CLIMATIC SUMMARY

Field ation: 40-00N 74-36W Field Elevation: 13

ITEM	ANNUAL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temperature													
Extreme Maximum	101	75	75	87	85	93	99	101	101	101	85	83	71
Mean Daily Maximum	63.1	42	44	51	61	72	81	86	83	76	66	54	42
Mean Daily Minimum	44.4	26	27	33	41	51	61	66	64	57	47	36	26
Extreme Minimum	-4	0	-4	6	22	34	42	50	42	36	26	19	-1
MEAN Number of Days													
Maximum equal or greater 90°F	21	0	0	0	0	#	5	9	6	1	0	0	0
Maximum equal or greater 80°F	86	0	0	#	1	6	19	26	22	10	2	#	0
Minimum equal or less 32°F	111	24	22	16	4	0	0	0	0	0	1	11	23
Minimum equal or less 0°F	#	#	0	0	0	0	0	0	0	0	0	0	#
Precipitation													
Mean Monthly													
Precipitation (Inches)	41.65	2.8	2.6	4.1	3.7	3.4	2.8	4.2	4.4	3.0	3.3	3.7	3.8
Snowfall (Inches)	13.80	4.6	1.9	3.8	0.3	0	0	0	0	0	#.	1.5	1.7
Mean Number of Days													
Measurable Precipitation	114.2	11	8	11	11	13	9	9	8	8	7	9	10
Measurable Snowfall	7.0	3	2	2	#	0	0	0	0	0	0	#	1
Snowfall equal or greater 1.5"	4.0	2	1	1	0	0	0	0	0	0	0	#	#
Flying Weather (Percent of Observations)													
Ceiling less 1500' and/or Visibility less 3 miles	19.6	22	19	19	18	20	17	17	21	20	17	22	19
Ceiling less 800' and/or Visibility less 2 miles	12.8	16	13	14	12	13	11	10	13	13	11	14	13
Ceiling less 200' and/or Visibility less ½ mile	2.8	4	3	3	2	4	2	2	3	3	3	4	2
Take off - Landing Data													
Mean Vapor Pressure (in Of Hg)	0.38	0.13			0.23			0.63			0.34		
Mean Dew Point Temperature	46	26	25	32	40	51	60	64	63	58	49	37	28
99.95% Pressure Altitude (feet)	950	900	800	950	850	650	600	550	450	600	700	800	800

- Less than 0.5

"About that snow forecast!"..

A WINTER WEATHER OUTLOOK FOR MCGUIRE AIR FORCE BASE

GENERAL: In winter, the McGuire area is no longer dominated by the mild Bermuda High Pressure Area as it was during summer and most of fall. Now we find that the principal air-masses are continental and maritime polar which follow the cold fronts passing the station every two or three days. Significantly, rain remains the principal precipitation type due, in part, to the proximity of the Atlantic Ocean and its modifying effects. Because of this, one of our major forecasting problems is the determination of snow vs. rain. It is not unusual to have ten inches of snow fall on Philadelphia (30 miles to the west) while only one or two inches of snow mixed with rain fall on McGuire from the same storm. Since we are nearly always on the rain-snow dividing line, freezing rain and/or sleet is a very real hazard throughout the winter months. Remember, when encountering freezing rain, a layer of warmer air will be above the aircraft; therefore, climb to evade freezing rain.

Low ceilings and visibilities will result mainly from stratus and fog, especially near dawn, and fog burn-off will be slow due to a lack of intense solar heating. Also, visibilities in falling snow will go below one mile on most occasions.

MONTHLY BRIEFS:

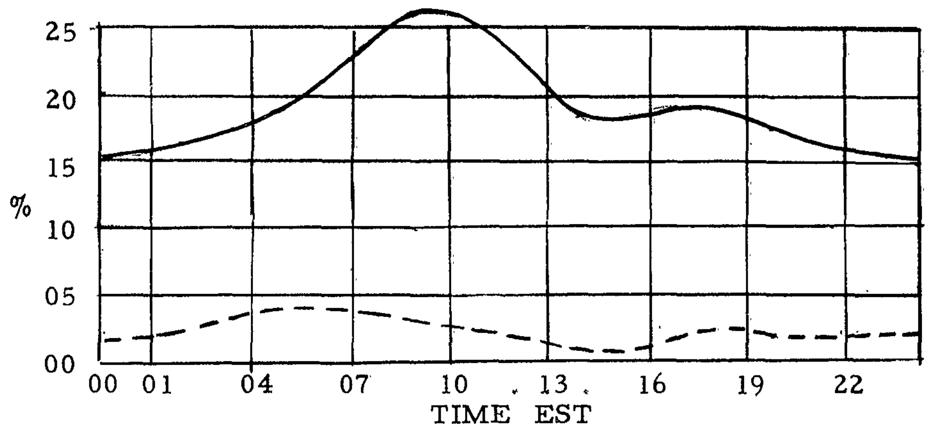
December: Although not the first month with snow, we may expect our first heavy storm this month (two inches or more) ... winter patterns well established creating stronger surface winds and more hours of excessive cross-winds on runway 06-24 ... 23 days with less than or equal to 32°F on the average.

January: This is our coldest month (24 days with less than or equal to 32°) ... greatest anticipated snowfall (4.6 inches) and most snow days (2.6 days with measurable snowfall) ... most hours below 200 ft and/or 1/2 mi (29.8).

February: Lowest recorded temperature (minus 4°F) ... may provide us with an unusually heavy and wet snowfall late in the month, otherwise this is a typical winter month.

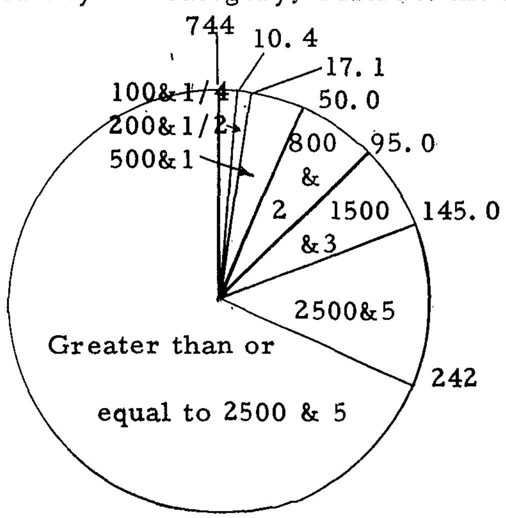
Detailed statistics for the months noted above begin on the next page.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for December showing the percentage of time below indicated minimums at all hours of an average day:

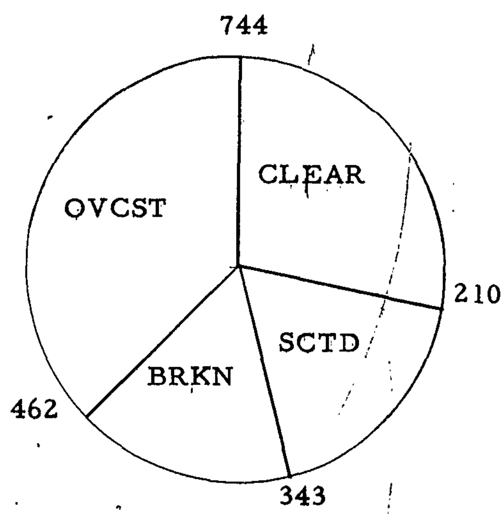


AVERAGE HOURLY FLYING WEATHER FOR DECEMBER
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve - less than 200 feet and/or 1/2mi.

To further examine the ceiling and visibility categories, the pie diagrams below show the the total hours per month of various sky conditions and significant operational minimums. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: Surface visibility is one of the most critical weather parameters, especially when values are marginal and flying may be curtailed due to closed field conditions. Also, pilots should keep in mind that all visibilities are measured horizontally and, with low ceilings and/or dense fog, may seem to be too high for the approaching pilot who is concerned with "slant-range" visibility. At McGuire, low visibilities are usually caused by some form of fog; most prevalent of which are advection fogs brought inland by steady easterly or south-easterly winds. Note the following table of comparative statistics:

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	26.8
Precipitation	7.4
Smoke and/or haze	0.7

Except when low visibilities are caused by precipitation, poorest conditions occur near sunrise and steadily improve thereafter.

PRECIPITATION: Although snow is a definite hazard during December, rain is the principal precipitation type. Also, with surface temperatures at or below freezing, falling rain or sleet creates a dangerous freezing rain condition for aircraft flying between the surface and 5000 feet.

SUMMARY OF DECEMBER PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	9.8
Measurable snowfall	0.9

Hours per month of:

Rain and/or drizzle	73.7
Snow and/or sleet	23.8
Thunderstorms	0.0
Freezing rain	1.3

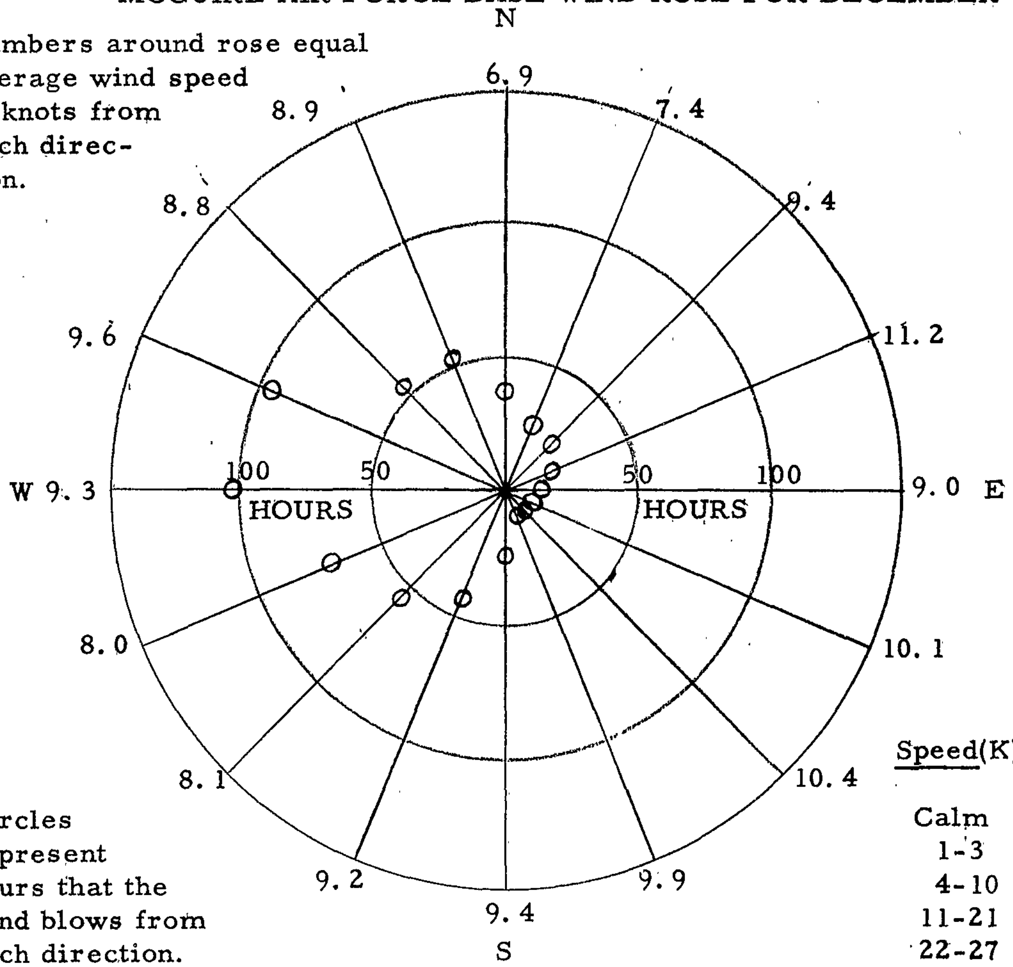
Inches of:

Mean monthly precipitation	3.77
Mean monthly snowfall	1.7

SURFACE WINDS: One of the major differences between the winter and summer seasons is the change from gusty conditions caused by convective activity to relatively steady, strong-wind conditions resulting from tighter pressure gradients. Below is a wind rose for December showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR DECEMBER

Numbers around rose equal average wind speed in knots from each direction.



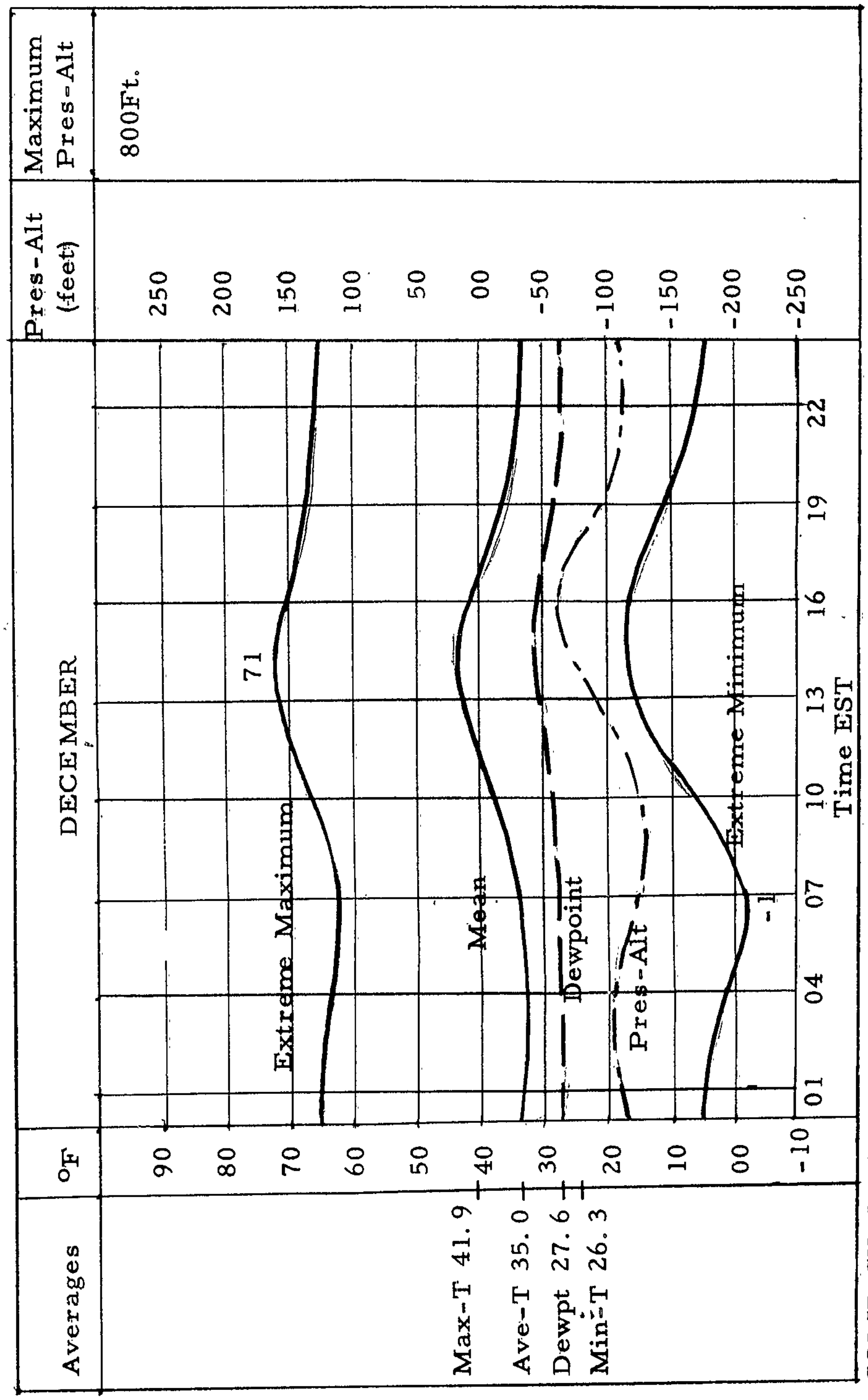
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	12.9
1-3	8.5
4-10	54.0
11-21	23.2
22-27	1.2
28-40	0.1

Prevailing wind direction . . . . West
Mean wind speed (knots) 7.7
Wind 4 knots or over (percent) 78.5
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 4.5
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 97

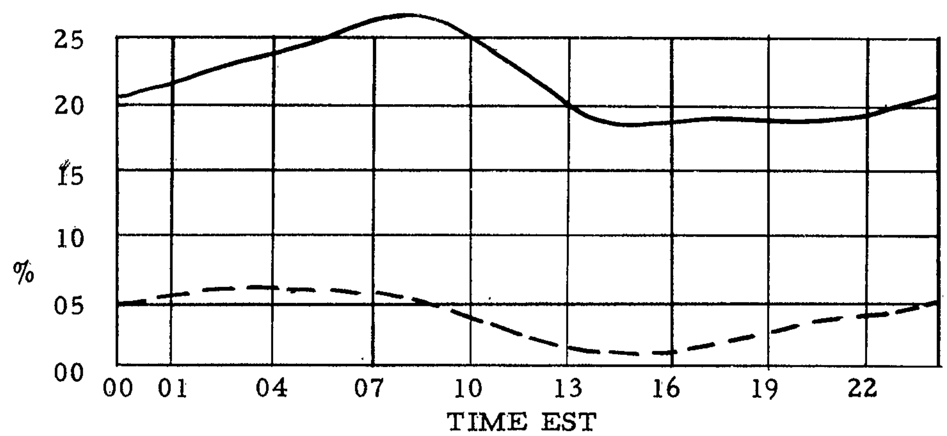
TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



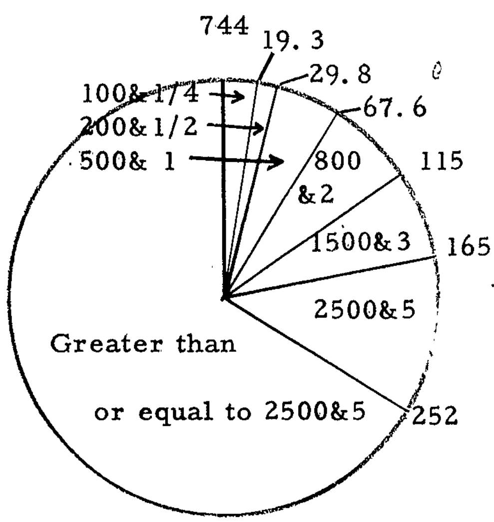
SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme mimimum temperature. DASHED CURVE: Mean dew point. DASH-DOT CURVE: Mean pressure altitude.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for January showing the percentage of time below indicated minimums at each hour of an average day.

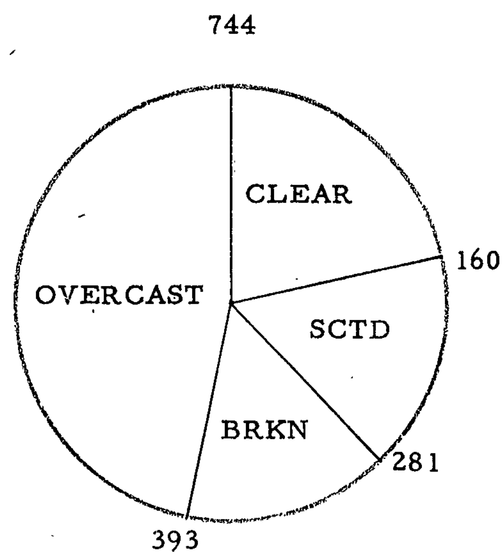


AVERAGE HOURLY FLYING WEATHER FOR JANUARY
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve = less than 200 feet and/or 1/2 mi.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: Fog is by far the most prevalent and persistent cause of low visibilities at east coast bases. At McGuire, approximately 80% of the visibilities less than one mile are due to some form of fog. Advection fogs, borne by easterly winds, and radiation fog, forming at night under clear skies, yield the poorest visibilities near dawn and are the most common fogs at McGuire. Since surface heating in January is near a minimum for the year, below minimum conditions originating in the evening may not lift again until mid-morning. Note the following table of comparative statistics:

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	44.5
Precipitation	8.2
Smoke and/or haze	1.5
Blowing snow and/or dust	0.0

Steady snow will nearly always lower the visibility to one mile or less.

PRECIPITATION: Although rain or rain mixed with snow is still the principal precipitation type in January, statistics show that the mean number of days with measurable snowfall as well as the inches of mean monthly snowfall are about triple the December values.

SUMMARY OF JANUARY PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	10.9
Measurable snowfall	2.6

Hours per month of:

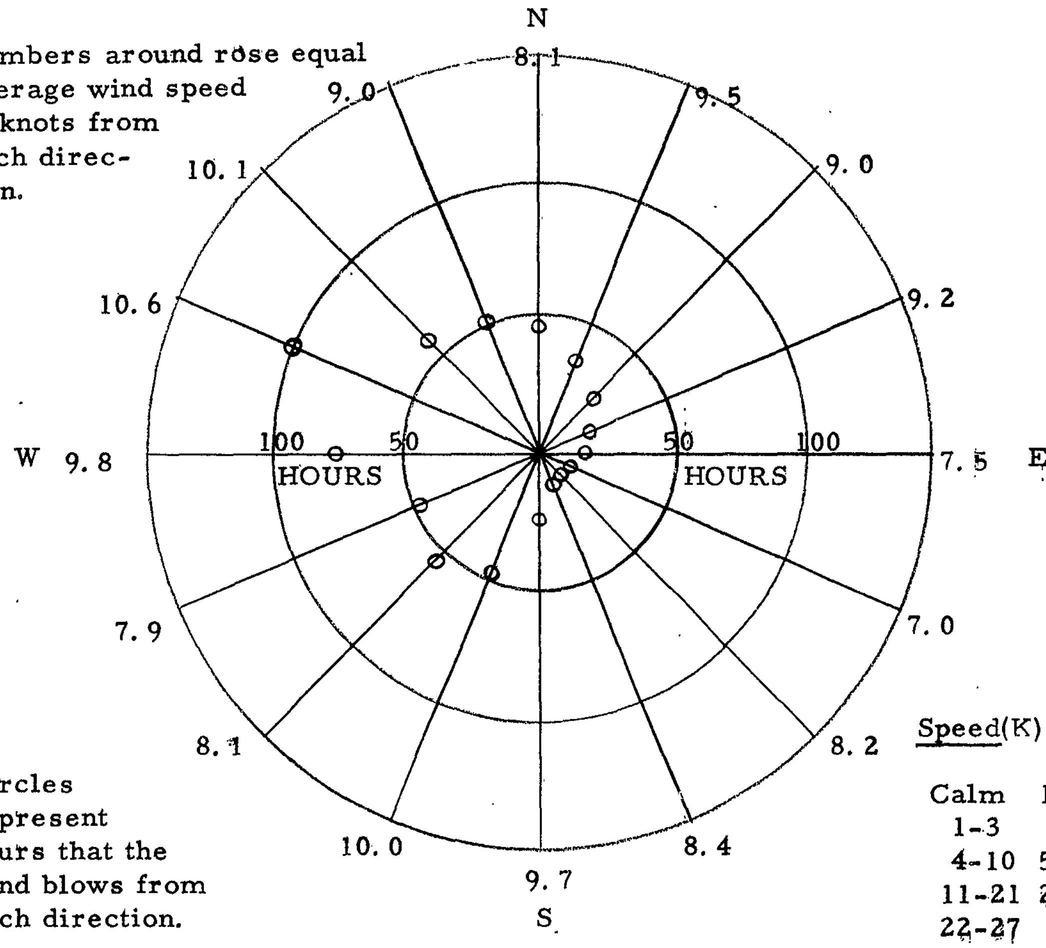
Rain and/or drizzle	74.4
Snow and/or sleet	29.8
Thunderstorms	0.0
Freezing rain	5.9

Inches of:

Mean monthly precipitation	2.80
Mean monthly snowfall	4.6

SURFACE WINDS: Since this is a typical winter month, we may expect strong gusty surface winds, especially immediately after the passage of strong cold fronts. These strong westerly winds will often create a turbulence hazard from the surface to about 5000 feet. Although primarily a daytime phenomenon, winds of this type may continue throughout the night as well. Below is a wind rose for January showing the average wind speeds and the hours from each direction.

MCGUIRE AIR FORCE BASE WIND ROSE FOR JANUARY



Numbers around rose equal average wind speed in knots from each direction.

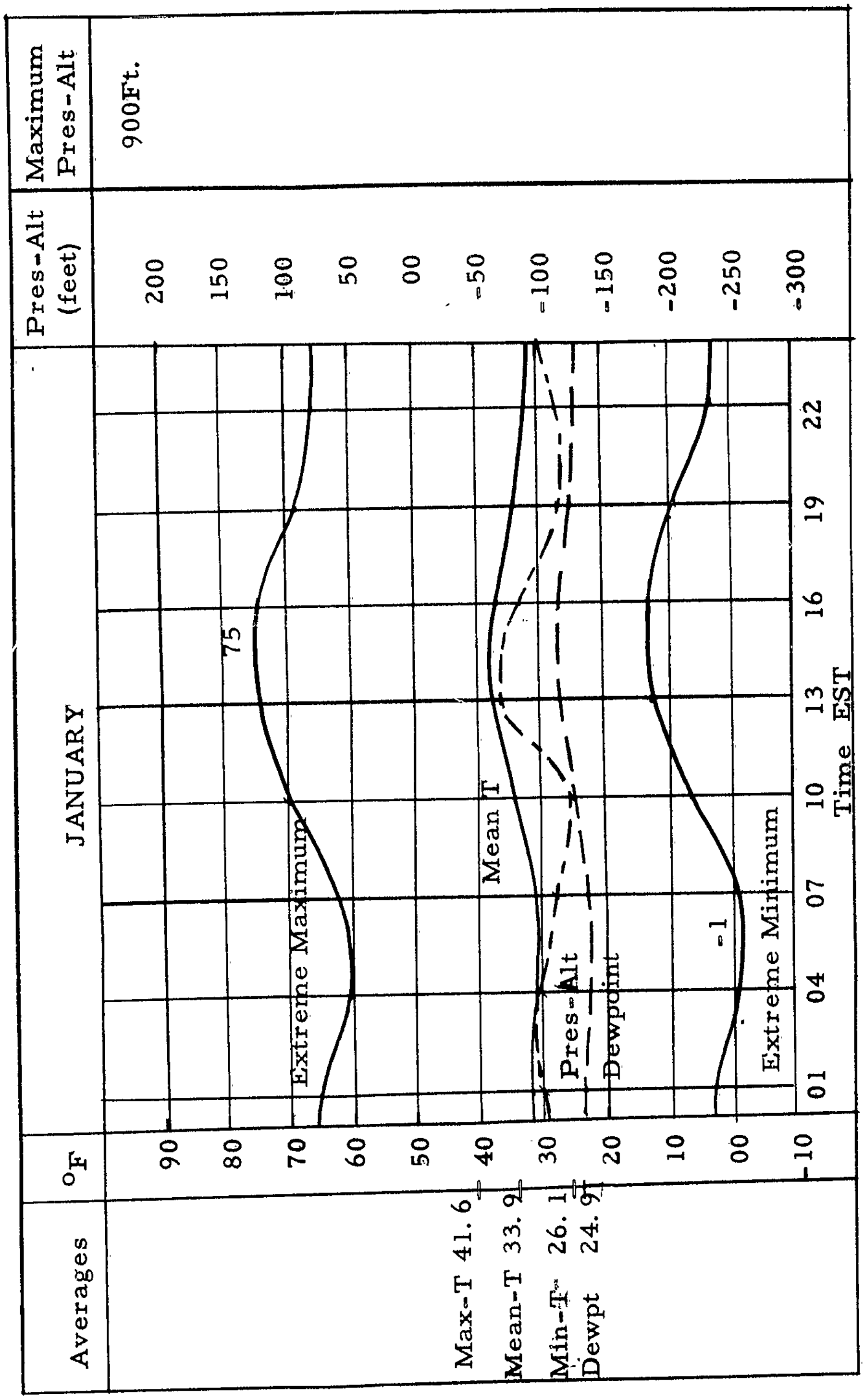
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	11.4
1-3	7.8
4-10	53.9
11-21	25.5
22-27	1.4
28-40	0.1

Prevailing wind direction . . . . WNW
Mean wind speed (knots) 8.2
Wind 4 knots or over (percent) 80.8
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 5.2
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 117

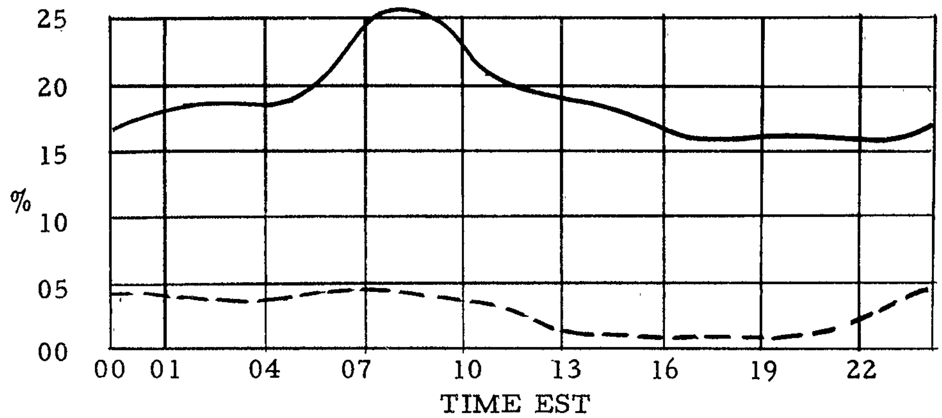
TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



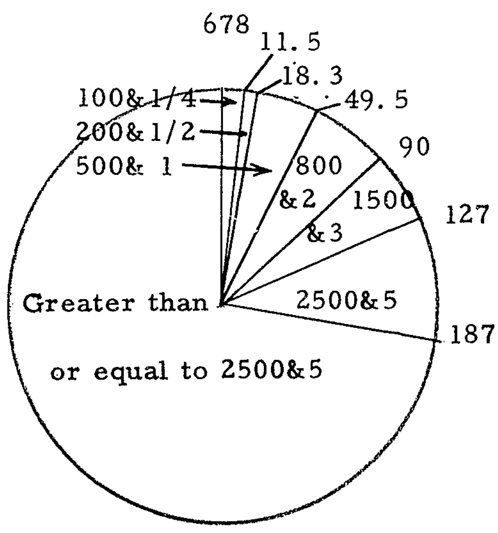
SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH-DOT CURVE: Mean pressure altitude.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for February showing the percentage of time below indicated minimums at each hour of an average day.

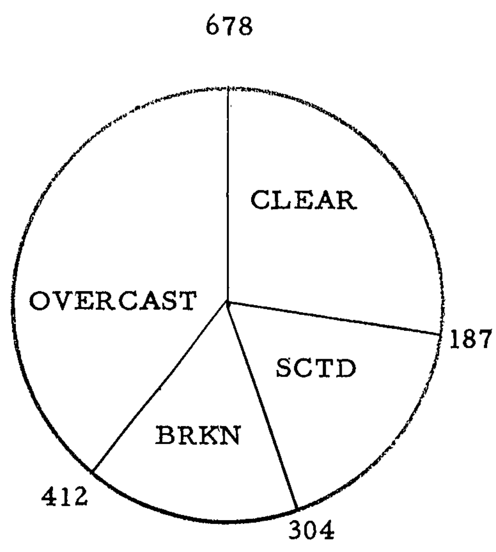


AVERAGE HOURLY FLYING WEATHER FOR FEBRUARY
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve-less than 200 feet and/or 1/2mi.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: In February we note a slight improvement in surface visibility. As stated previously, fog is still the major cause of poor visibility during this and other months. Some tips for flyers: Slant-range visibility in radiation or patchy ground fog is often better than officially reported - until the last few feet of your descent; winds from the northwest quadrant provide the best visibilities, whereas those from the east through southwest provide the poorest; if the visibility at midnight is near field minimums and no change of airmass is forecast, then expect no improvement or possible deterioration by dawn. Note the following table of comparative statistics:

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	28.5
Precipitation	4.1
Smoke and/or haze.	0.7
Blowing snow and/or dust . . .	0.0

When approaching a field during precipitating conditions, the "windshield factor" may decrease considerably an otherwise good reported visibility.

PRECIPITATION: Statistics indicate that total snowfall and mean number of days with snow are on the decline; however, snowfall extremes are very difficult to predict and tend to depart considerably from the mean. One storm can easily triple the "expected snowfall" for a month during one 24 hour period. Also, be prepared for a possible very heavy snowfall during February or March; a late storm of this nature seems to occur every two or three years at McGuire.

SUMMARY OF FEBRUARY PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	8.4
Measurable snowfall	1.1

Hours per month of:

Rain and/or drizzle	72.0
Snow and/or sleet	23.7
Thunderstorms	0.0
Freezing rain	4.8

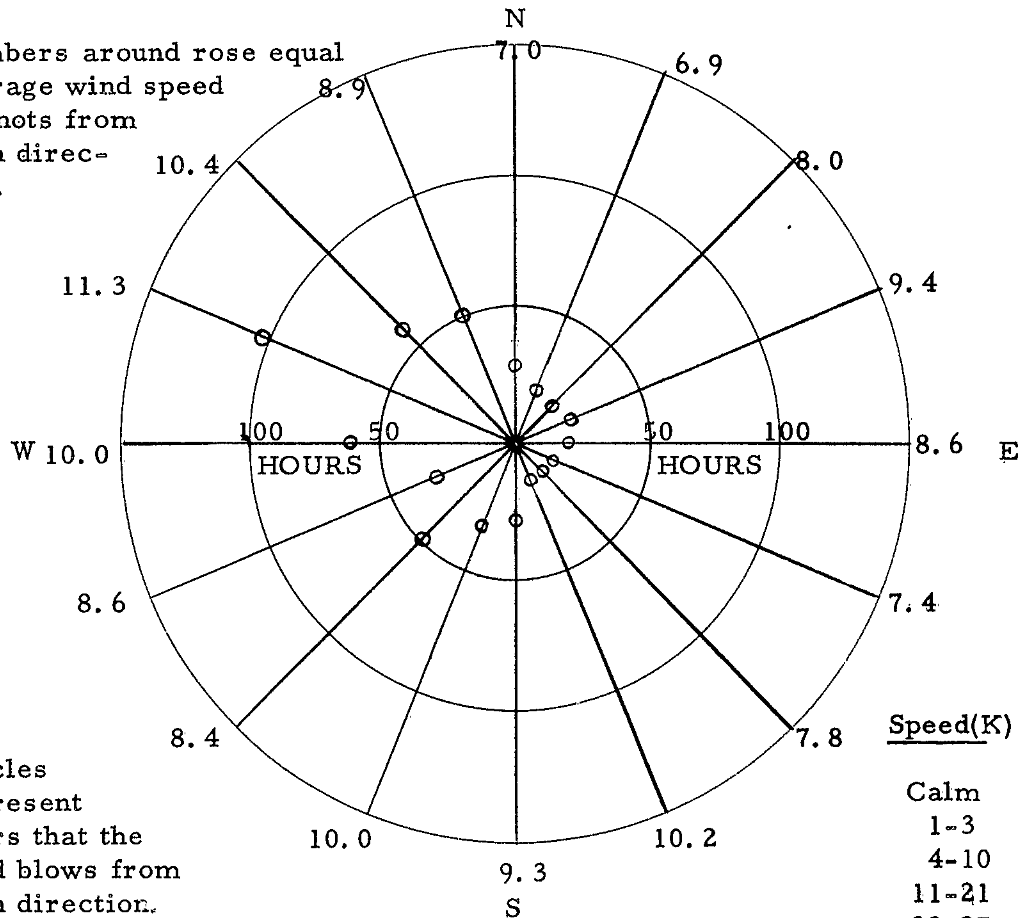
Inches of:

Mean monthly precipitation.	2.62
Mean monthly snowfall	1.9

SURFACE WINDS: The February wind picture is almost identical to that which occurred in January. Prevailing wind direction and speed are nearly the same; however, there is a slight increase in the average number of hours of excessive cross-wind conditions. Below is a wind rose for February showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR FEBRUARY

Numbers around rose equal average wind speed in knots from each direction.



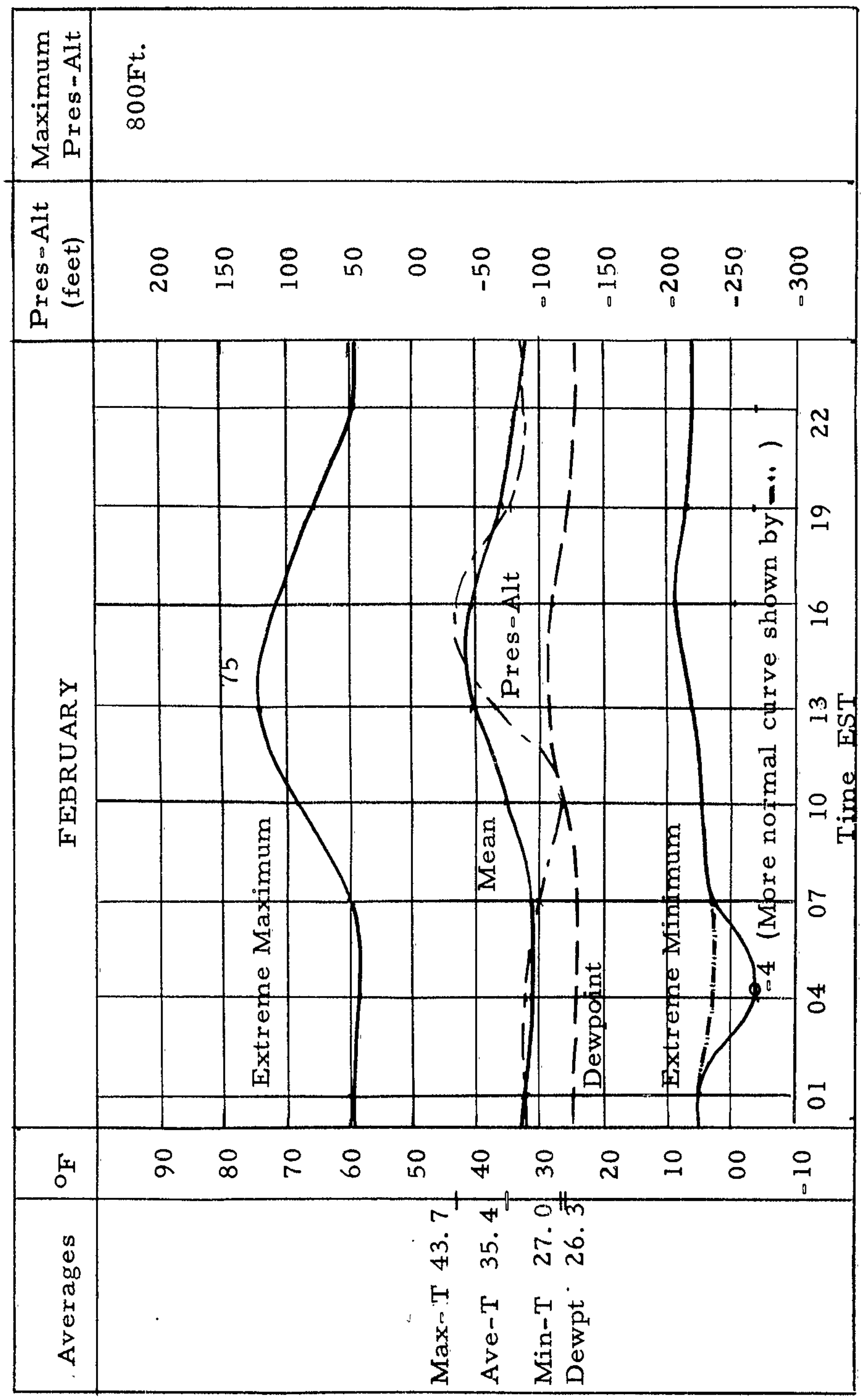
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	11.1
1-3	8.1
4-10	53.1
11-21	25.8
22-27	1.7
28-40	0.1

Prevailing wind direction . . . . WNW
Mean wind speed (knots) 8.3
Wind 4 knots or over (percent) 80.7
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 6.8
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 123

TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH - DOT CURVE: Mean pressure altitude.

"RIGHT, CLEAR AND 15 ALL THE WAY"

"RIGHT, CLEAR AND 15 ALL THE WAY"

A SPRING WEATHER OUTLOOK FOR McGUIRE AIR FORCE BASE

GENERAL: Spring is the season of rising temperatures and decreasing cyclonic activity. Although early March is often typical of the winter months with intense cyclonic storminess (and sometimes snow), by mid March the increased solar heating becomes evident and temperatures start their upward climb at the rate of 10 degrees per month. McGuire averages 12 frontal passages per month during both February and March but by April this average drops to 8 per month. Early spring is still a period of strong surface winds and in fact, March averages more days with surface winds gusting to 25 knots than any other month. An appreciable decrease in wind speeds is not evident until May. In spring the soil is still satuarated from the thawing snow and slow evaporating winter rains. This cool moist ground is very condusive to the formation of fog which reaches a maximum in May. Thunderstorms are rare in March but the probability of occurrence increases steadily thereafter as summer approaches.

Early spring is a good time to brush-up on your knowledge of thunderstorms. The cold air rushing down from the core of the thundercloud fans out at the surface often ten miles or more ahead of the storm itself. This initial "blast" is in most respects indentical to a sharp cold front passage. The first surface gust is usually the strongest and associated with it there may be a rapid wind shift from southwest to northwest. The maximum horizontal extent of a thunderstorm cloud is usually found at 10,000 feet and the sky coverage cuts in half every ten thousand feet above this. The most severe flight conditions are found in the layer 1000 feet above the freezing level. During summer the average freezing level at McGuire is found at 15,000 feet.

MONTHLY BRIEFS:

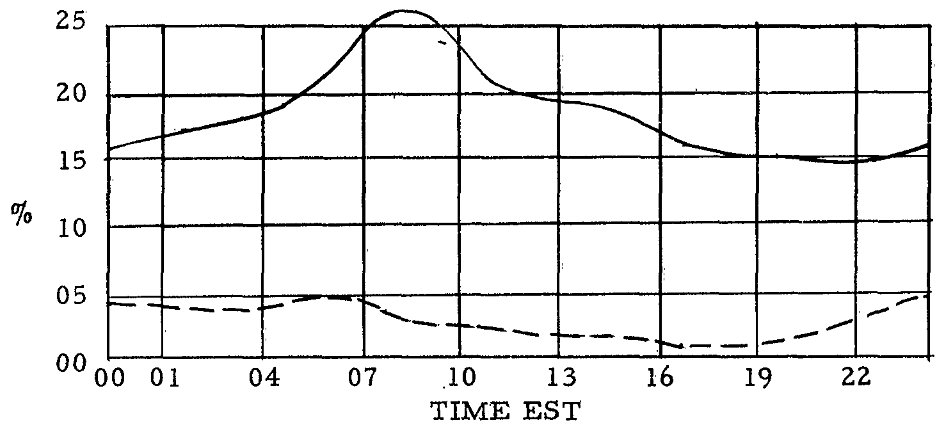
March: The expression "In like a lion, out like a lamb" is very appropriate for March. Early March is typical of the winter months while by the end of March storminess is noticeably decreased. Strong surface winds (which are a maximum in March) create the most serious forecasting problem.

April: Snow is rare but has occured in April. Thunderstorms are now a threat. Surface winds decrease only slightly over March. Temperatures are rising rapidly. An average of 4 days per month can be expected with temperatures below freezing.

May: The frequency of low ceilings and visibilities reaches a secondary maximum during May; however, the low conditions occur in early morning and improve rapidly 2-3 hours after sunrise. For example the percent of time McGuire is below 500 and/or 1 mile decreases from 9.0% at 0600L to 3.0% at 1000L and 0.9% at 1400L.

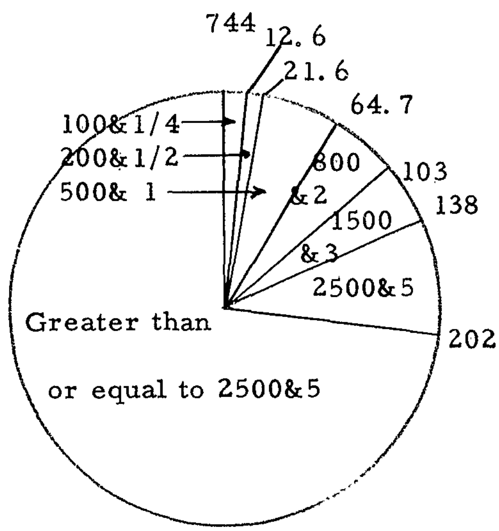
Detailed statistics for the months noted above begin on the next page.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for March showing the percentage of time below indicated minimums at each hour of an average day:

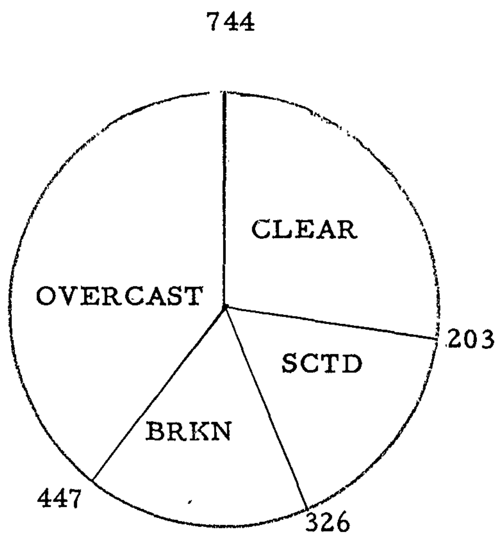


AVERAGE HOURLY FLYING WEATHER FOR MARCH
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve - less than 200 feet and/or 1/2mi.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various sky conditions and significant operational minimums. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: In most respects, the visibility characteristics during March are nearly identical with those of February with the possible exception that, due to increased daily warming, fog burn-off will occur progressively earlier as the month passes. A significant decrease in poor visibility is seen in the April statistics; however, part of this improvement takes place during the latter days of March. Throughout the spring season, brief shower activity (snow or rain) will lower the visibility abruptly for periods of less than one half hour. Sudden changes of this nature are not generally reflected in our statistics. Note the following table:

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	31.2
Precipitation	6.7
Smoke and/or haze	0.0
Blowing snow and/or dust	0.7

PRECIPITATION: Characteristically, spring weather situations tend to oscillate between those of winter and summer. That is, we may have a period of persistent rain and/or snow followed, in a few days, by wind squalls and intermittent shower activity. As in February, there is a chance that one unusually heavy snowstorm will strike McGuire with a total snow depth in excess of 5 inches. If this occurs, it will usually fall in the form of large, wet flakes of great weight. The accumulation should melt rapidly, however, due to the warming trend following in two or three days.

SUMMARY OF MARCH PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	11.3
Measurable snowfall	1.7

Hours per month of:

Rain and/or drizzle	94.5
Snow and/or sleet	23.0
Thunderstorms	0.0
Freezing rain	0.7

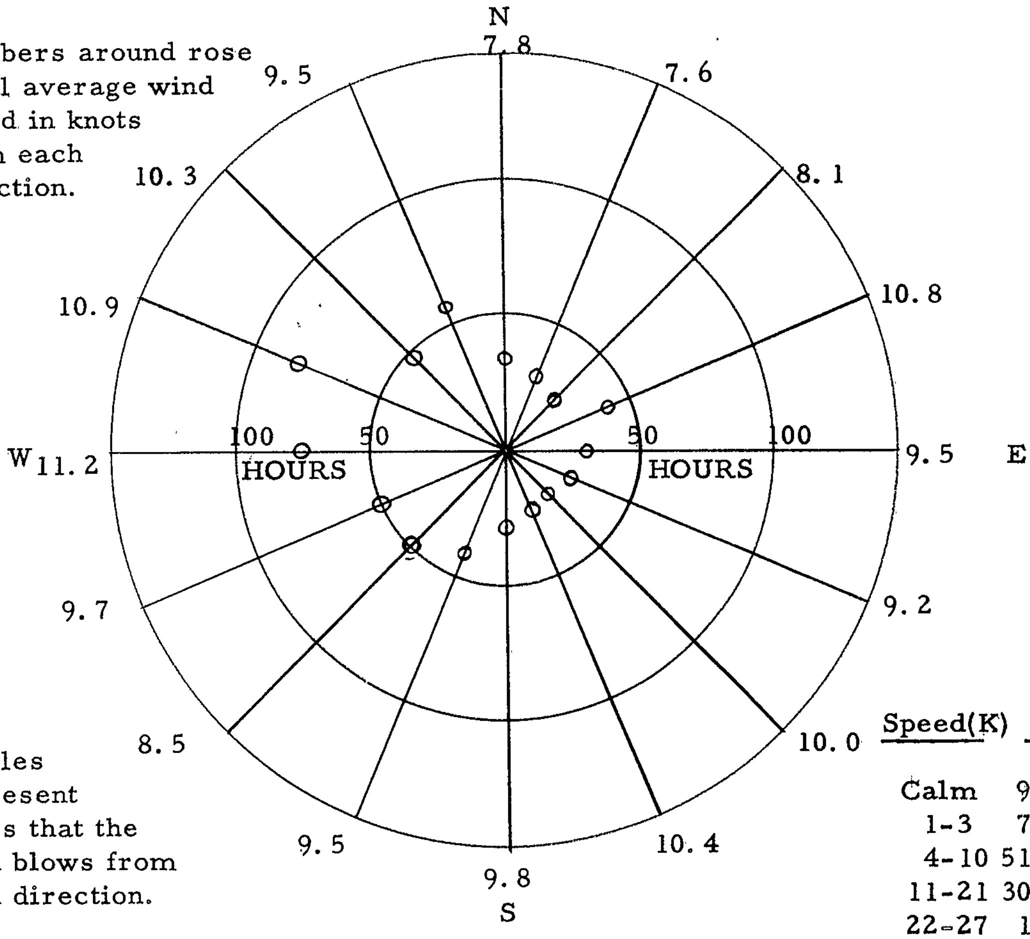
Inches of:

Mean monthly precipitation	4.08
Mean monthly snowfall	3.8

SURFACE WINDS: March, being a month of transition, will exhibit characteristics of both winter and summer weather situations. Strong pressure gradients, a hold-over from winter, combined with greater surface heating tend to produce our windiest weather for the year. Below is a wind rose showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR MARCH

Numbers around rose equal average wind speed in knots from each direction.



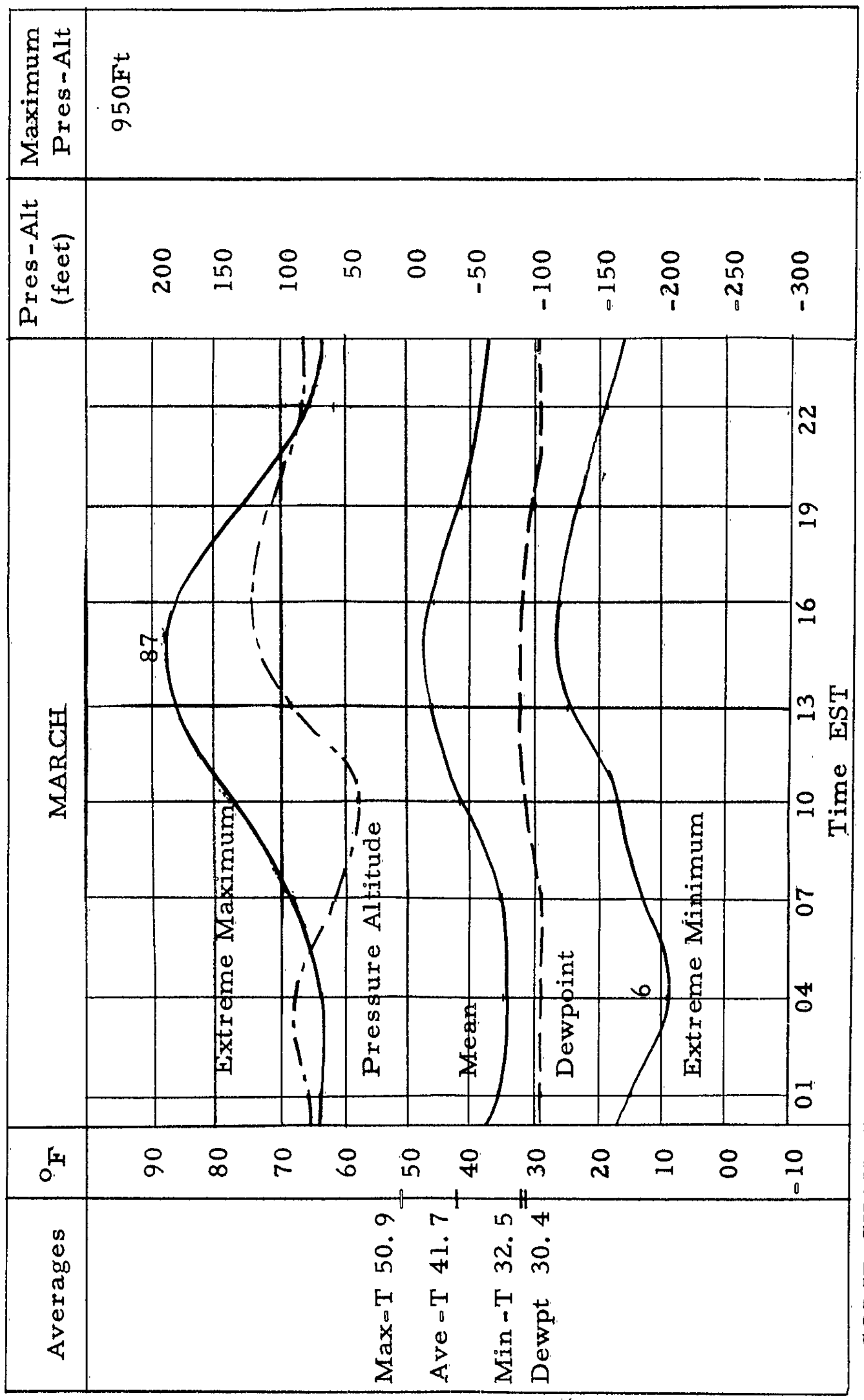
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	9.5
1-3	7.2
4-10	51.2
11-21	30.1
22-27	1.8
28-40	0.1

Prevailing wind direction . . . . WNW
Mean wind speed (knots) 8.8
Wind 4 knots or over (percent) 83.2
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 6.0
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 136

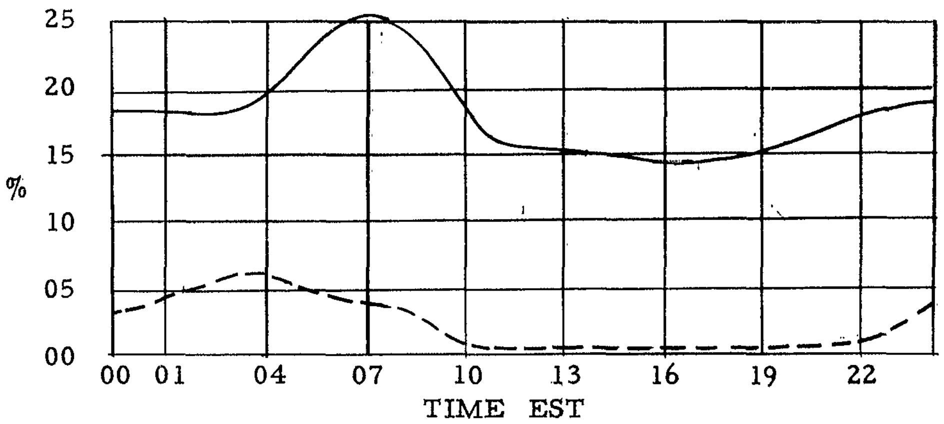
TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



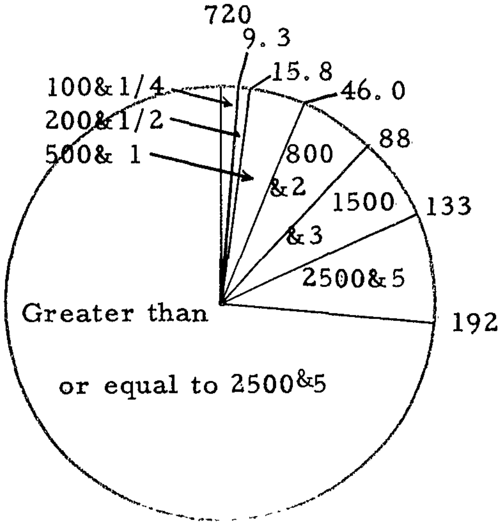
SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH - DOT CURVE: Mean pressure altitude.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for April showing the percentage of time below indicated minimums at each hour of an average day:

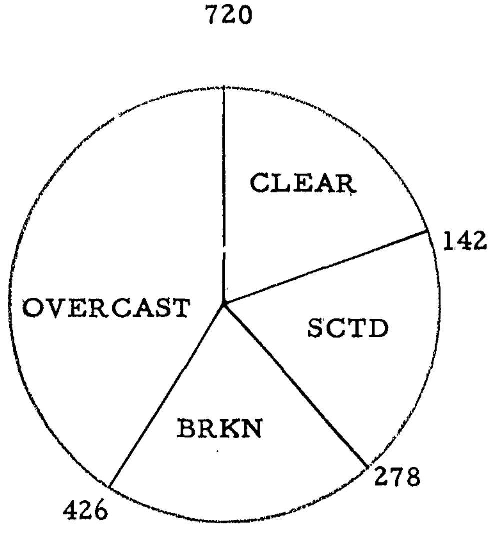


AVERAGE HOURLY FLYING WEATHER FOR APRIL
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve- less than 200 feet and/or 1/2mi.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: April is one of the most fog free months of the year. As the ground warms, advection fog occurs less frequently and the relatively high wind speeds keep radiation type fog to a minimum.

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	21.6
Precipitation	1.4
Smoke and/or haze	0.0
Blowing snow and/or dust	0.0

PRECIPITATION: Both the amount and number of days with precipitation decreases in April as compared to March. The probability of snow is considerably reduced; however, during the first two weeks of April snow might occur. Thunderstorms are now a consideration, usually in association with cold frontal passages.

SUMMARY OF APRIL PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	10.5
Measurable snowfall	0.3

Hours per month of:

Rain and/or drizzle	100.7
Snow and/or sleet	5.7
Thunderstorms	2.9
Freezing rain	0.0

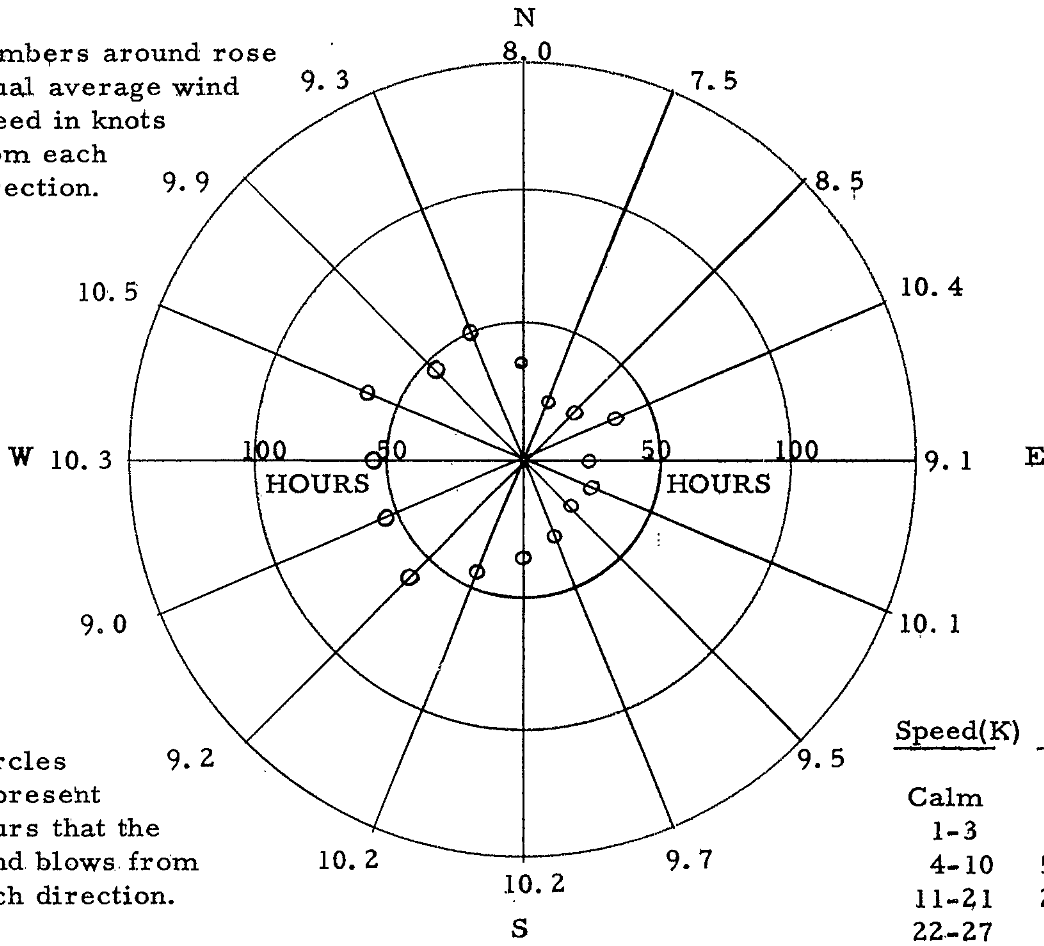
Inches of:

Mean monthly precipitation	3.74
Mean monthly snowfall	0.3

SURFACE WINDS: This month, like March, may still exhibit winter weather systems. However, we must now begin to consider in earnest the added problem of thunderstorm occurrences. Therefore, when applying the following data, remember that thunderstorm gusts are not reflected. Below is a wind rose for April showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR APRIL

Numbers around rose equal average wind speed in knots from each direction.



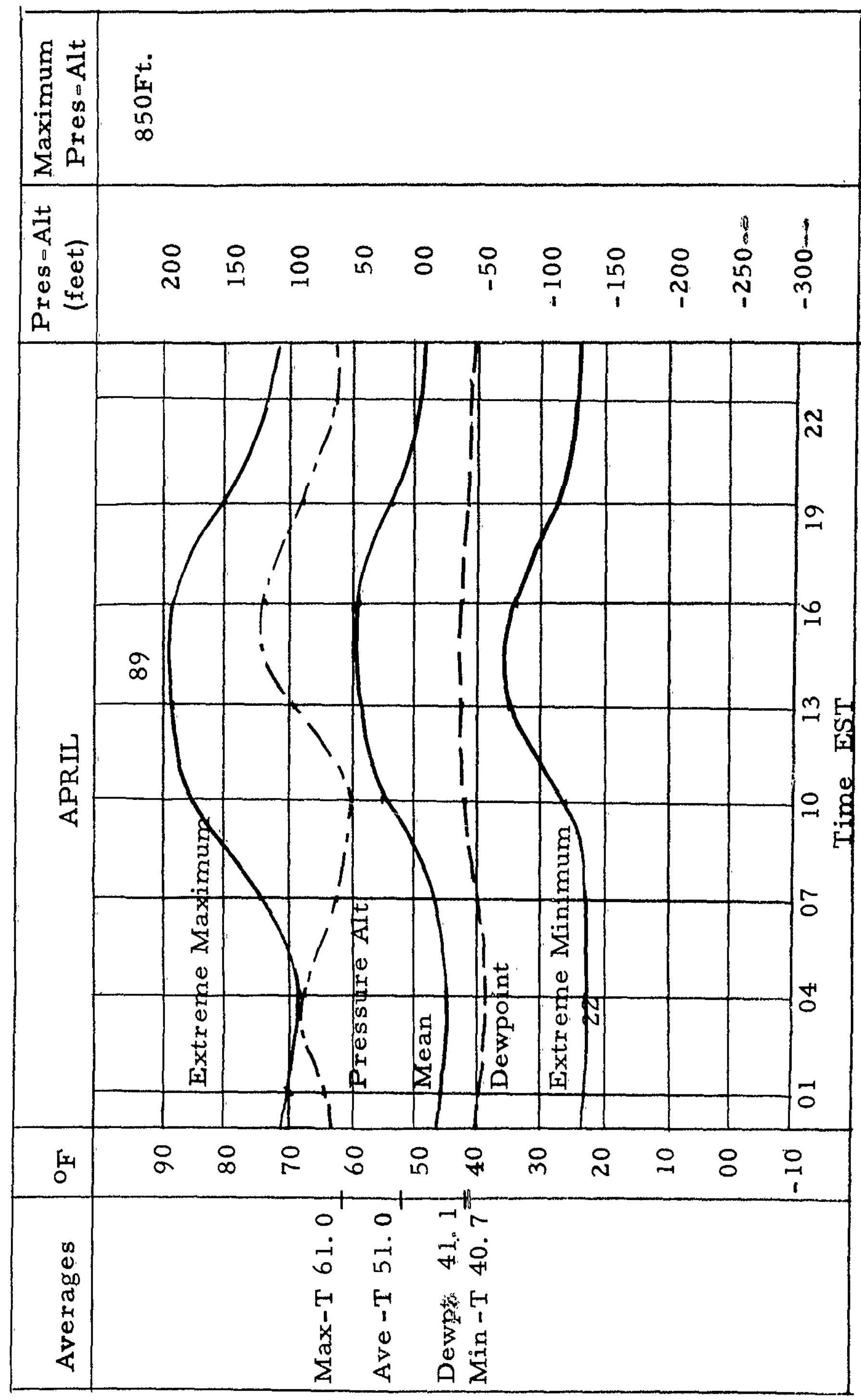
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	11.5
1-3	7.3
4-10	51.4
11-21	28.4
22-27	1.3
28-40	0.1

Prevailing wind direction . . . . WNW
Mean wind speed (knots) 8.5
Wind 4 knots or over (percent) 81.1
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 6.5
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 119

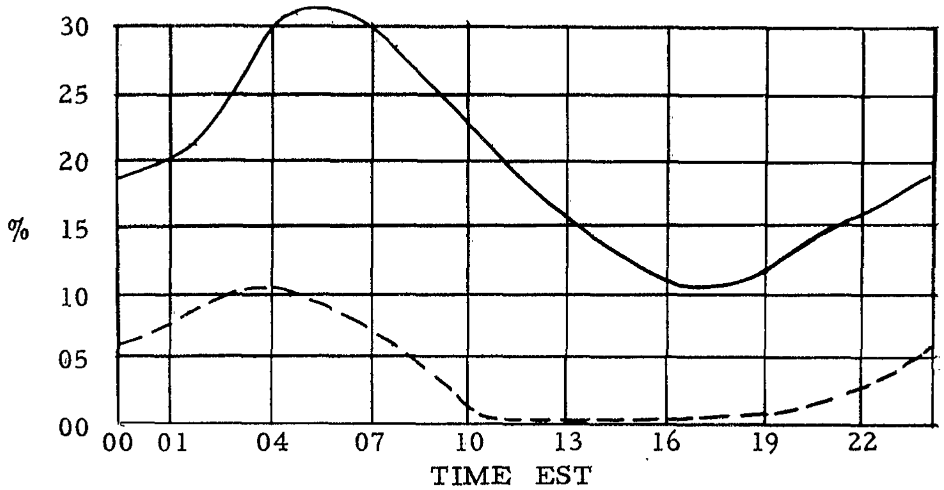
TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



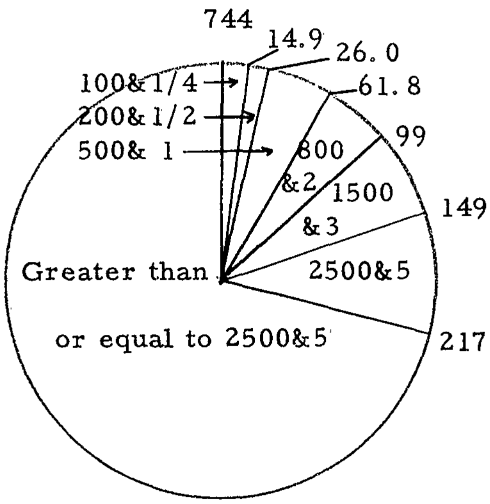
SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH - DOT CURVE: Mean pressure altitude.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for May showing the percentage of time below indicated minimums at each hour of an average day:

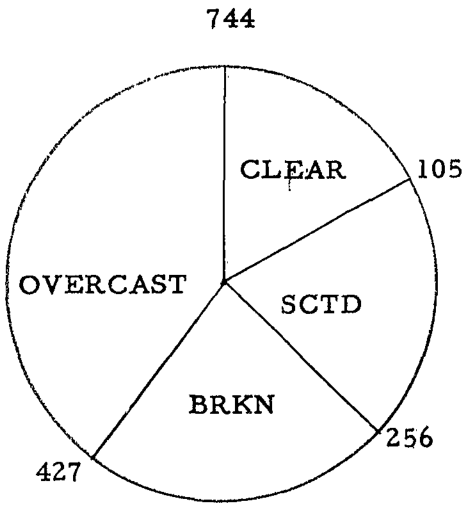


AVERAGE HOURLY FLYING WEATHER FOR MAY
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve- less than 200 feet and/or 1/2mi.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: The decrease in mean wind speeds together with the moist spring ground favor the high frequency of radiation type fog. As a result of radiation fog, May is only surpassed by January as the month with the lowest percent of poor flying weather. Solar heating rapidly dissipates the fog so that visibilities in the afternoon are far better than those in the colder months.

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	35.7
Precipitation	2.2
Smoke and/or haze	0.0
Blowing snow and/or dust	0.0

PRECIPITATION: The duration and amount of precipitation during May is again decreased over that of April. The probability of thunderstorms considerably increases over April.

SUMMARY OF MAY PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	12.5
Measurable snowfall	0.0

Hours per month of:

Rain and/or drizzle	89.4
Snow and/or sleet	0.0
Thunderstorms	6.7
Freezing rain	0.0

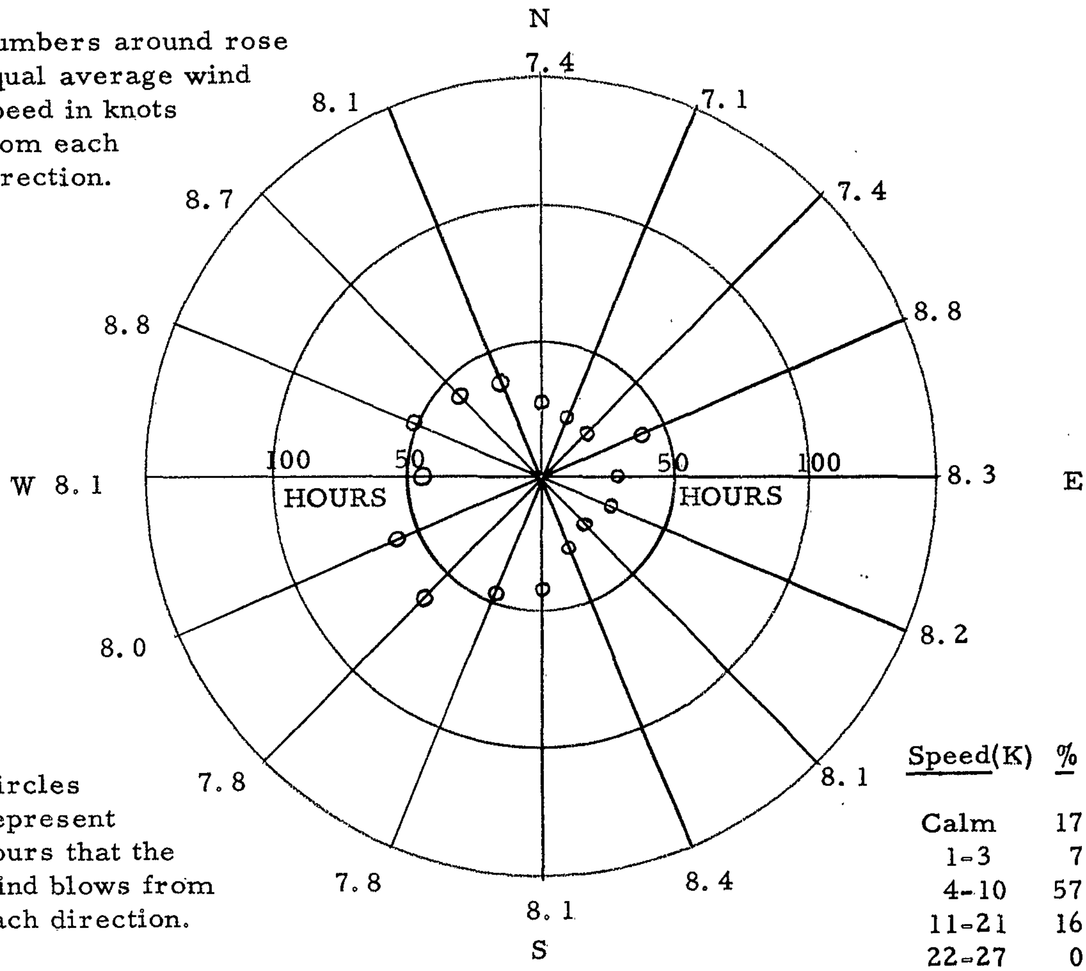
Inches Of:

Mean monthly precipitation	3.35
Mean monthly snowfall	0.0

SURFACE WINDS: Note the obvious drop in wind speed this month, as well as the shift in direction toward the southwest. This may be explained by the presence of the mild Bermuda High which now begins to dominate our weather. Below is a wind rose showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR MAY

Numbers around rose equal average wind speed in knots from each direction.



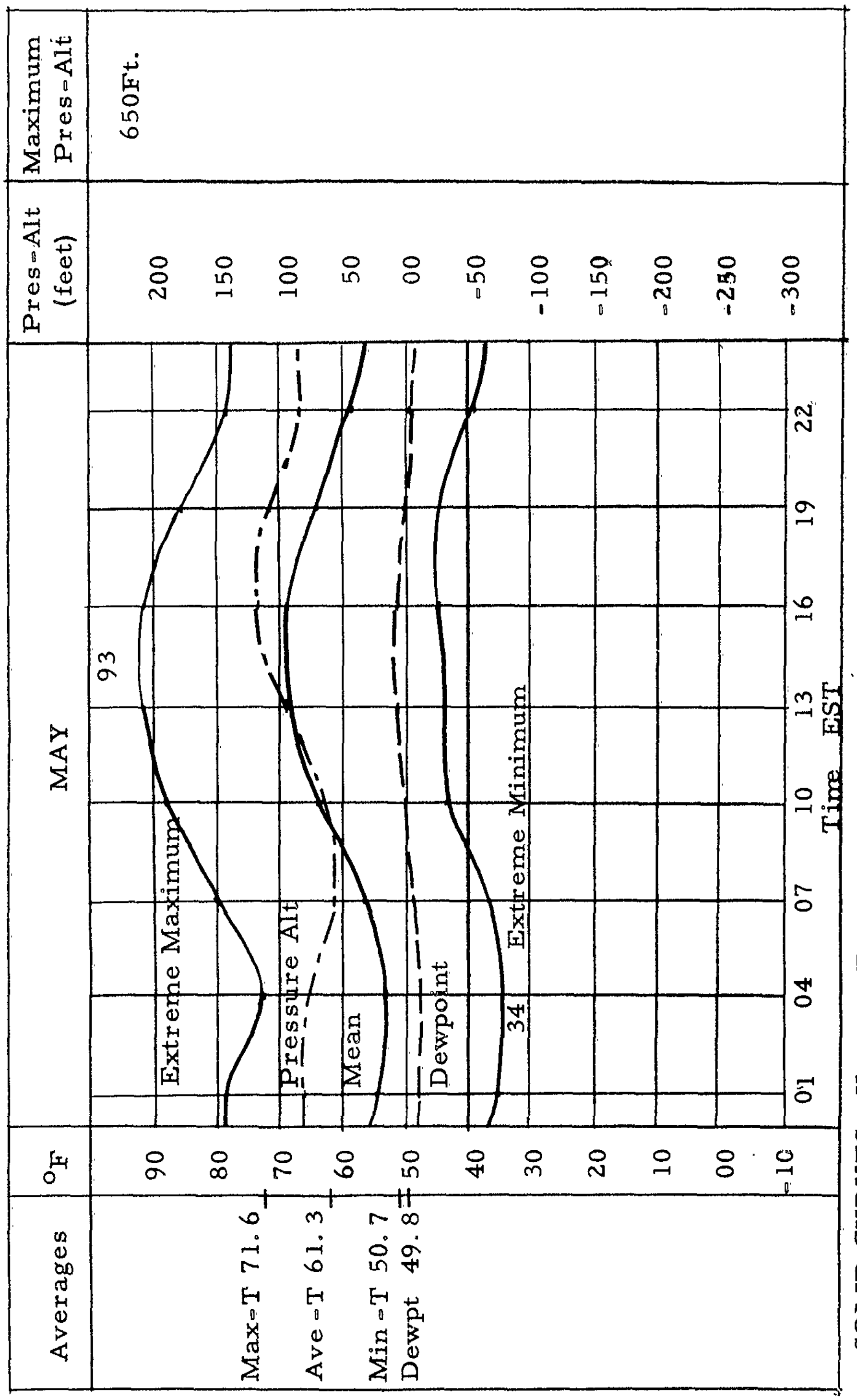
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	17.5
1-3	7.8
4-10	57.9
11-21	16.5
22-27	0.2

Prevailing wind direction . . . . SW
Mean wind speed (knots) 6.7
Wind 4 knots or over (percent) 74.7
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 0.1
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 63

TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are provided.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH - DOT CURVE: Mean pressure altitude.

"NICE SH... ER FORM COLONEL."

A SUMMER WEATHER OUTLOOK FOR McGUIRE AIR FORCE BASE

GENERAL: The Bermuda high is the predominating weather influence at McGuire during the summer months. The prevailing southwesterly winds advect maritime tropical air over the middle Atlantic states which is characterized by haze conditions both at the surfac and aloft. In the afternoons surface visibilities generally improve to 5-6 miles while visibilities aloft decrease to 3-4 miles as the shallow morning haze layer lifts to altitudes at 10,000 feet or more with afternoon heating. Thunderstorm activity reaches a maximum in July and during all summer months thunderstorms present the most significant weather hazard. Although the amount of precipitation in a maximum in summer, the rainfall is usually showery in nature and therefore of short duration. Wind speeds are significantly lighter than during the winter and spring months. Wind gusts over 25 knots are rare except when associated with thunderstorms or tropical storms. Temperatures over 90 degrees can be expected 5 days in June, 9 in July and 6 in August.

One of the trickiest weather phenomena to forecast during summer is the daily fluxuations in visibility. Below field minimum visibilities occur as or more frequently in summer than in winter during the hour on either side of sunrise. Winter visibilities improve slowly throughout the day whereas summer visibilities improve rapidly 1-2 hours after sunrise. However a general haze condition usually prevails so that surface visibilities often remain near 5 miles. In spite of the higher overall frequency of below minimum conditions in winter, there are more days with excellent visibility in winter than in summer. For example, in February 41% of the visibilities are 10 miles or better while in August this drops to 29%.

The variation of visibility with altitude should be a consideration if you are planning a VFR flight. During a summer morning with a typical shallow ground fog, surface visibilities may be reduced to near Zero but visibilities aloft above 1000 feet will be excellent. By 1000L surface visibilities will be improve to 3-4 miles and this haze condition will extend to 5-6000 feet. By 1400L the surface visibility will be 5-6 miles and visibilities aloft up to 10-000 feet may be 1-3 miles.

MONTHLY BRIEFS:

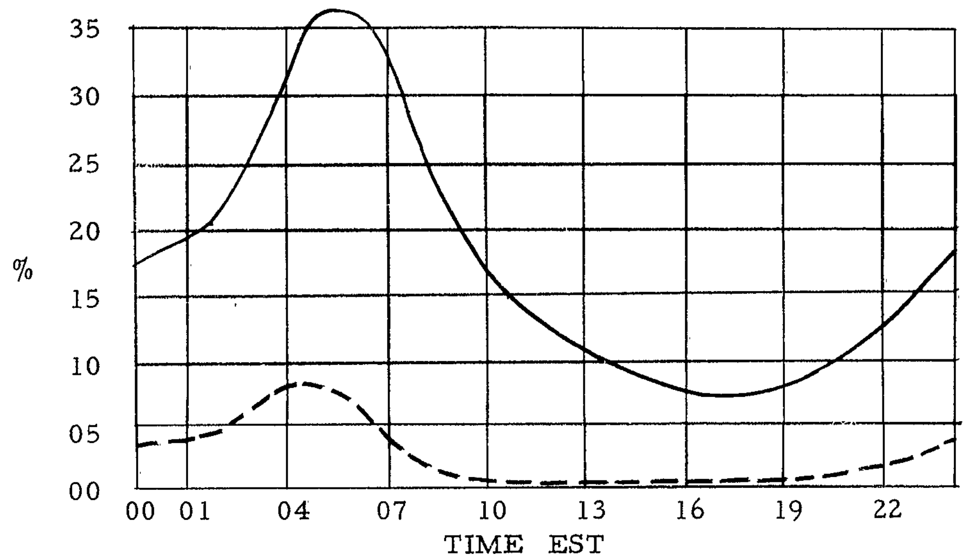
June: With the onset of summer, there is a noticeable increase in the frequency of favorable flying weather. The frequency of below 500 and/or 1 mile decrease from 8% in May to 5.5% in June. The mean sky cover drops from 6.4 tenths to 5 tenths.

July: This is the hottest of the summer months. Temperatures over 90 degrees can be expected 9 days during the month and temperatures over 100 degrees at least one day. Thunderstorm activity reaches a maximum in July. But on the optimistic side, favorable flying weather also reaches a mximum. Conditions below 500 feet and/or 1 mile only occur 4.7% of the time.

August... Although very similar to July, there is a slight decrease in temperatures, thunderstorm activity and favorable flying weather. Another threat is now developing in the form of tropical storms and hurricanes. It's a good bet that at least one such storm will threaten the Atlantic seaboard during August.

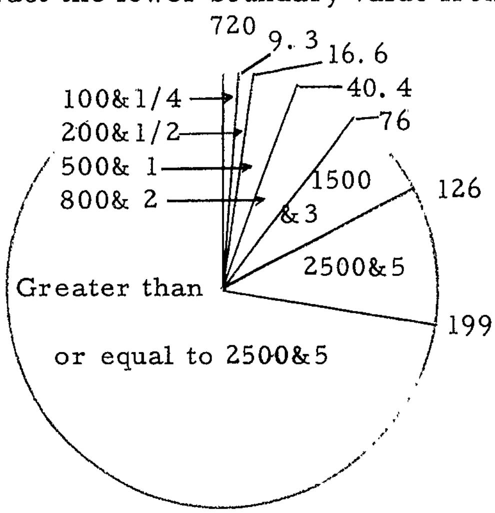
Detailed statistics for the months noted above begin on the next page.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for June [illegible]; the percentage of time below indicated minimums at each hour of an average day:

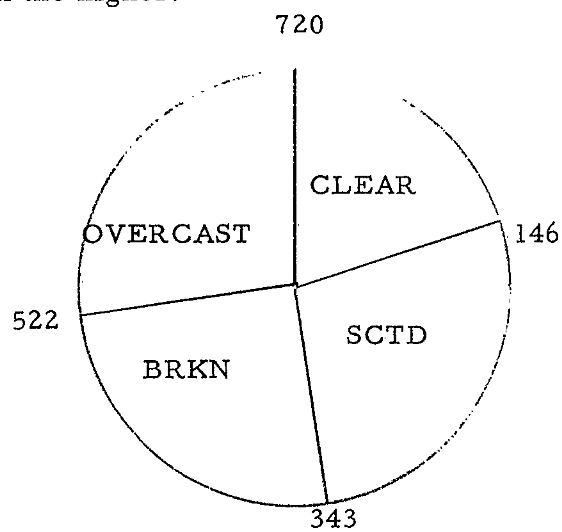


AVERAGE HOURLY FLYING WEATHER FOR JUNE
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve - less than 200 feet and/or 1/2 mile.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: At all times of the year the lowest visibilities occur 60 to 90 minutes after sunrise. Low morning visibilities have a higher incidence during June than any during any other month. Since the visibilities improve so rapidly 2 to 3 hours after sunrise, the overall daily average of low visibilities is far less in June than during the colder months.

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	25.2
Precipitation	1.4
Smoke and/or haze	0.0
Blowing snow and/or dust	0.0

PRECIPITATION: June also shows a decrease in precipitation amount and duration. A minimum of precipitation is reached in June as a result of the decrease in prolonged periods of continuous rain or snow associated with winter frontal systems. Although showery type of precipitation is increasing the showers are not as heavy as those in July or August.

SUMMARY OF JUNE PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	.1
Measurable snowfall	0.0

Hours per month of:

Rain and/or drizzle	59.0
Snow and/or sleet	0.0
Thunderstorms	8.6
Freezing rain	0.0

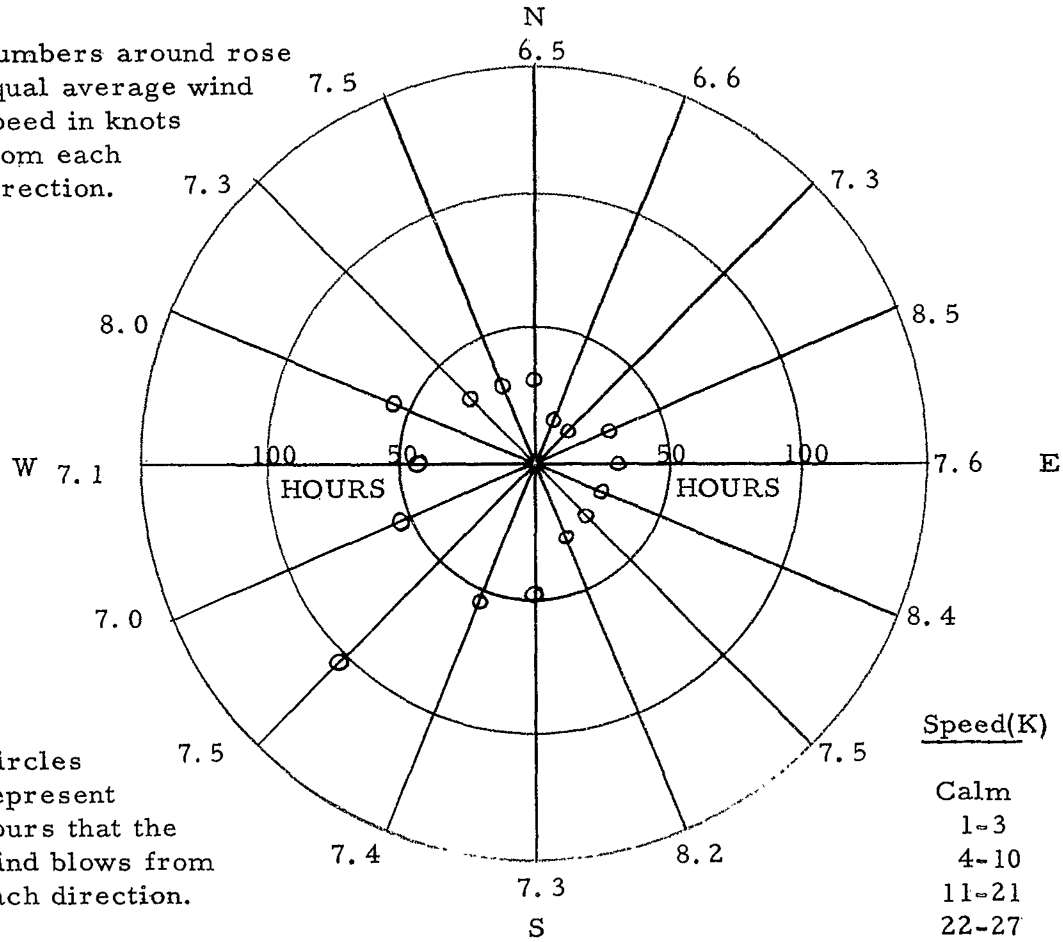
Inches of:

Mean monthly precipitation	2.79
Mean monthly snowfall	0.0

SURFACE WINDS: During the summer months, surface wind speeds have a definite diurnal variation. That is: a maximum during the daylight hours and a marked drop after sundown. Abrupt changes in speed and/or direction accompanying convective currents are common. Below is a wind rose for June showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR JUNE

Numbers around rose equal average wind speed in knots from each direction.



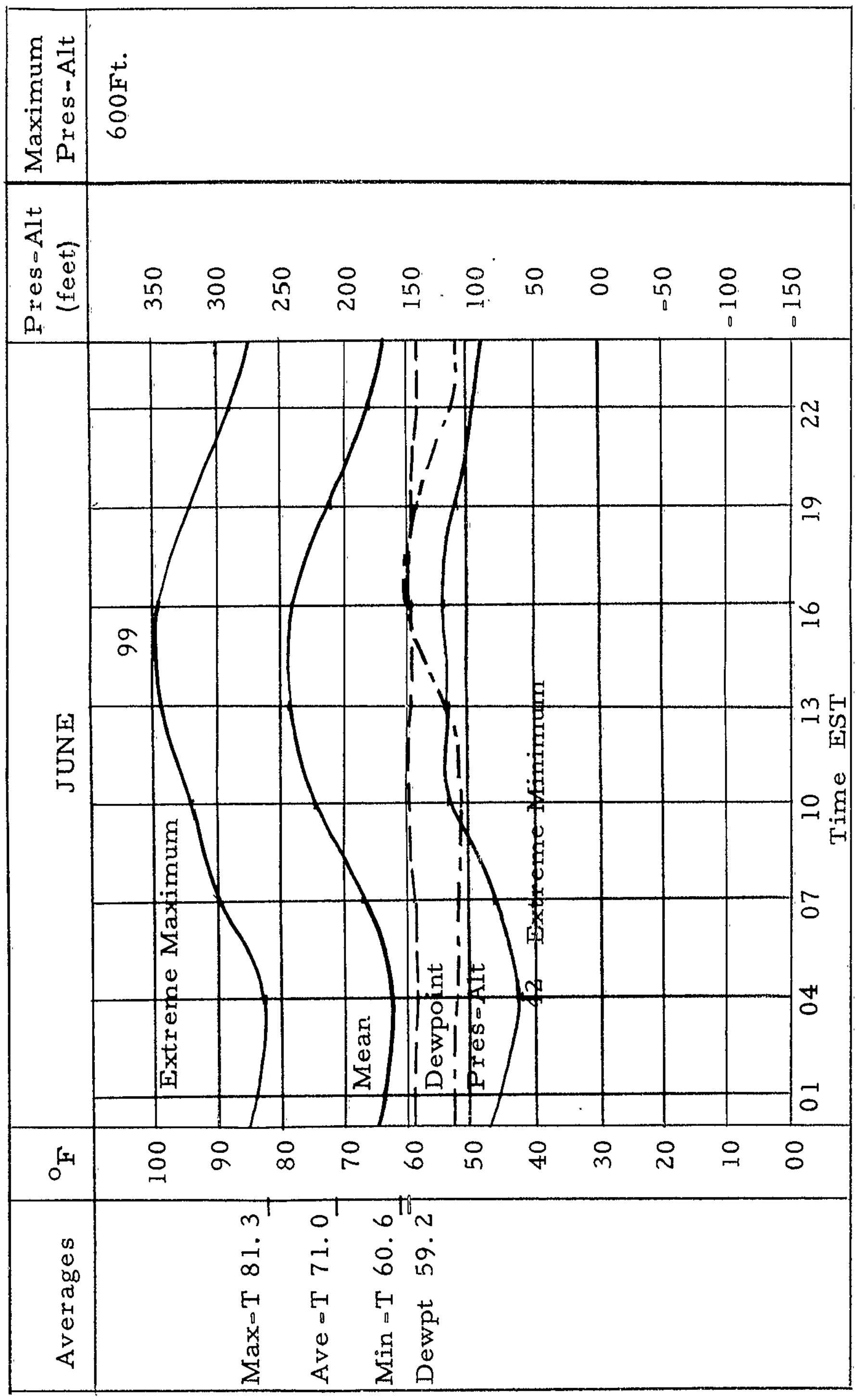
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	15.4
1-3	9.4
4-10	63.6
11-21	11.5
22-27	0.1
28-40	0.0

Prevailing wind direction . . . . SW
Mean wind speed (knots) 6.3
Wind 4 knots or over (percent) 75.2
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 0.1
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 44

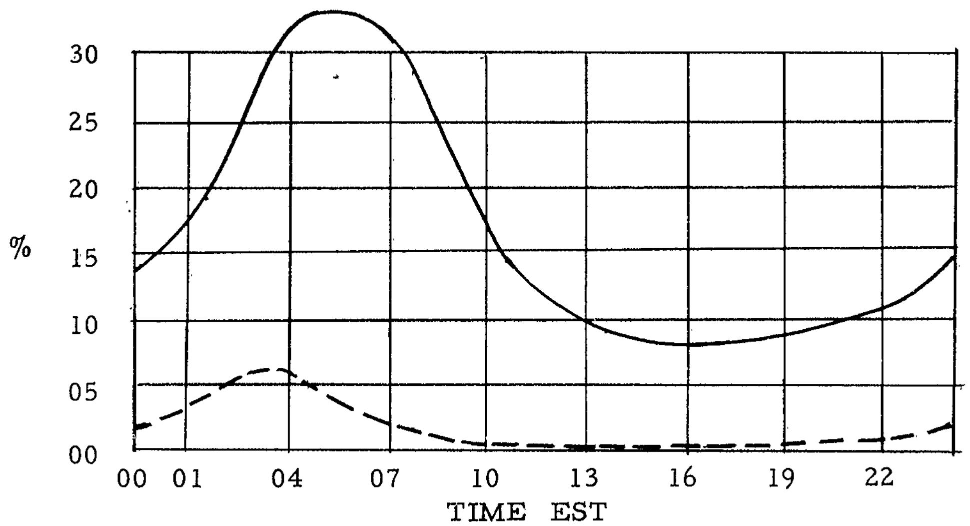
TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



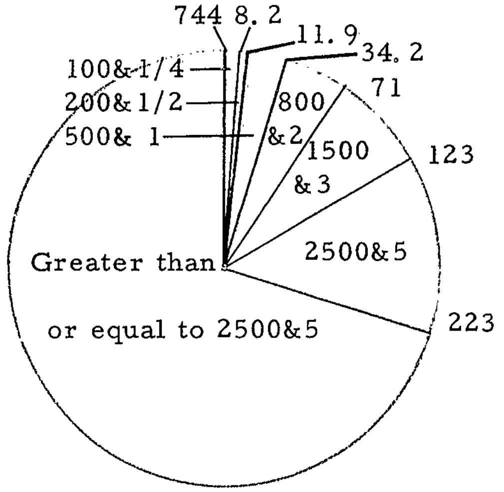
SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH - DOT CURVE: Mean pressure altitude.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for July showing the percentage of time below indicated minimums at each hour of an average day:

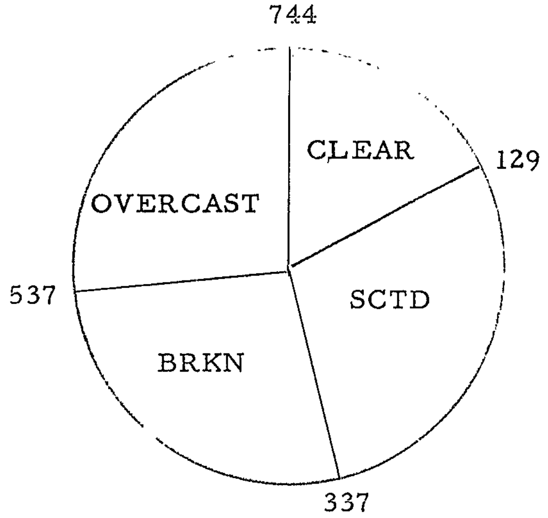


AVERAGE HOURLY FLYING WEATHER FOR JULY
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve - less than 200 feet and/or 1/2 mile.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: Considering the 24 hour day, average visibilities are better during July than during any other month. However the frequency of fog or low visibilities during the early morning hours is actually higher than it is during January (the month of poorest visibilities). Radiation fog which causes the reduced summertime morning visibilities is both patchy and shallow. Since visibilities will fluxuate or vary considerably over small areas, nearby alternates can usually be found even though McGuire might be below minimum. In addition, being shallow, radiation fog burns-off very rapidly starting one to two hours after sunrise.

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	20.8
Precipitation	1.5
Smoke and/or haze	0.7
Blowing snow and/or dust	0.0

PRECIPITATION: The number of days with precipitation in July is only slightly increased over the number in June. The amount of precipitation is considerably increased in July as a result of heavier shower activity. This is evidenced by the increase in thunderstorm activity which is a maximum in July and August.

SUMMARY OF JULY PRECIPITATION STATISTICS:

Mean number of day with:

Measurable precipitation	9.2
Measurable snowfall	0.0

Hours per month of:

Rain and/or drizzle	52.8
Snow and/or sleet	0.0
Thunderstorms	11.9
Freezing rain	0.0

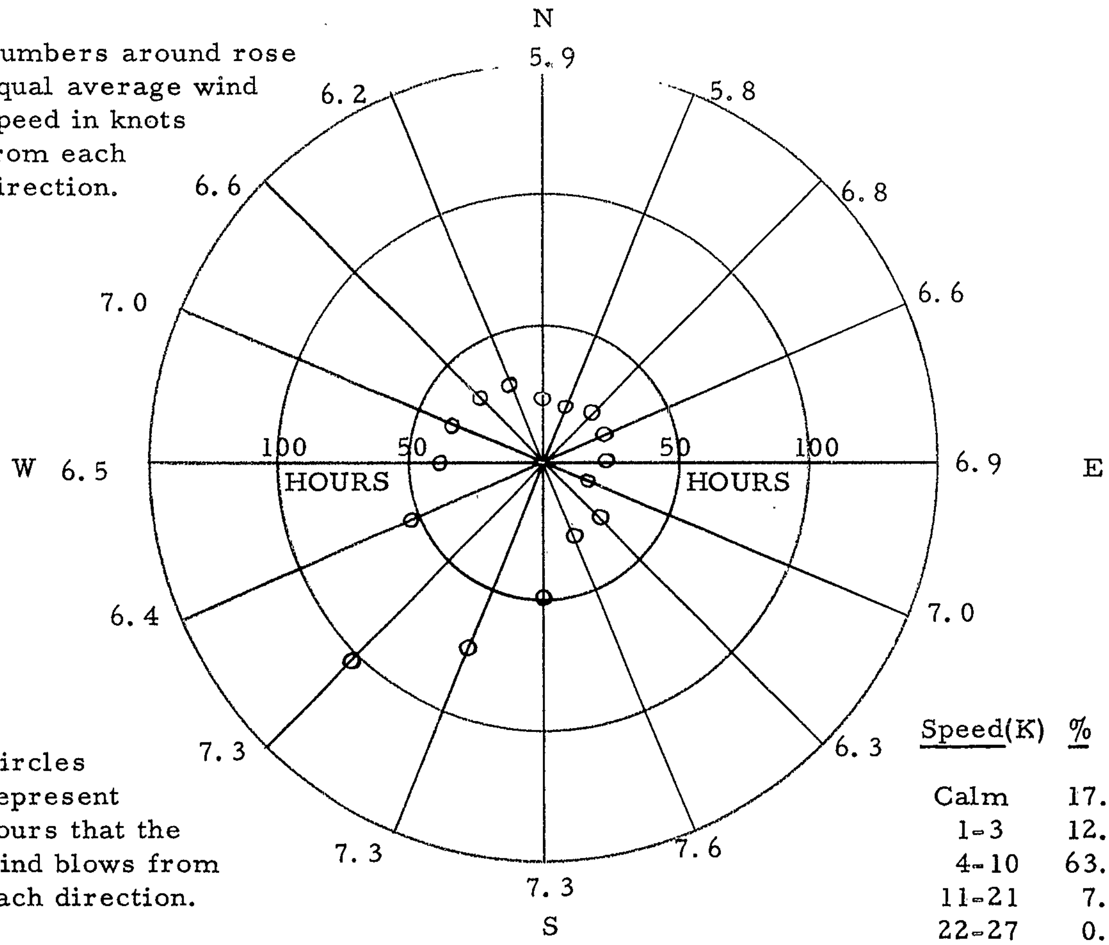
Inches of:

Mean monthly precipitation	4.15
Mean monthly snowfall	0.0

SURFACE WINDS: In July, prevailing winds are light; however, gusts caused by brief convective showers and/or thunderstorms may exceed 50 knots. Also, there is a remote possibility that a hurricane will influence our region. Winds caused by these phenomena are not reflected below. Following is a wind rose for July showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR JULY

Numbers around rose equal average wind speed in knots from each direction.



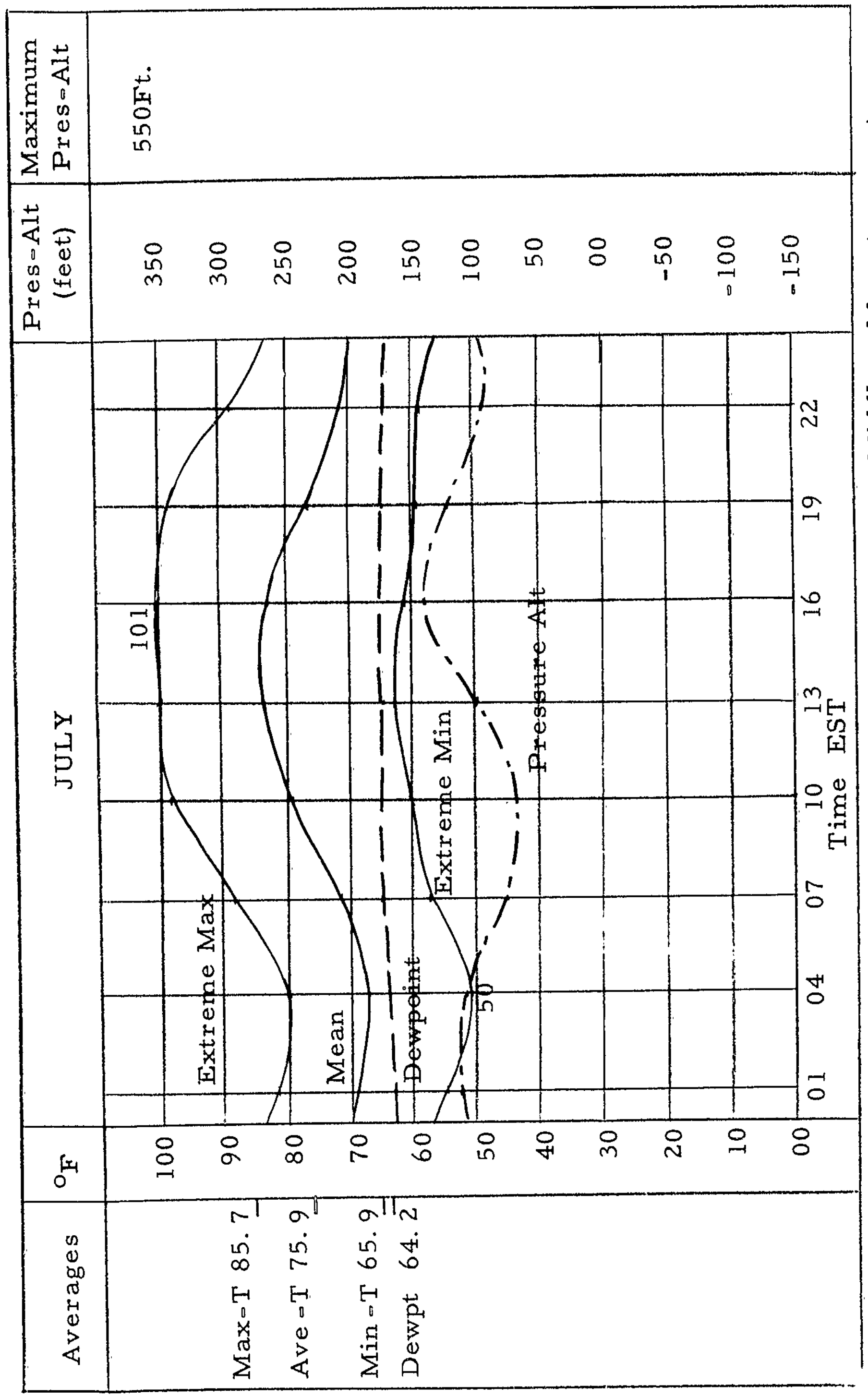
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	17.2
1-3	12.1
4-10	63.3
11-21	7.3
22-27	0.1

Prevailing wind direction . . . . SW
Mean wind speed (knots) 5.7
Wind 4 knots or over (percent) 70.6
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 0.0
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 22

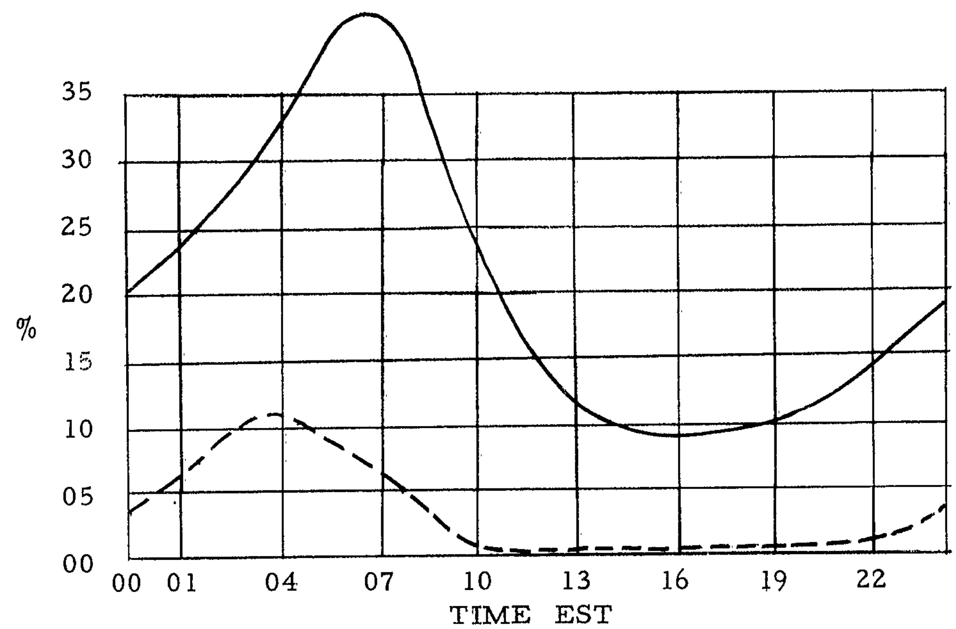
TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



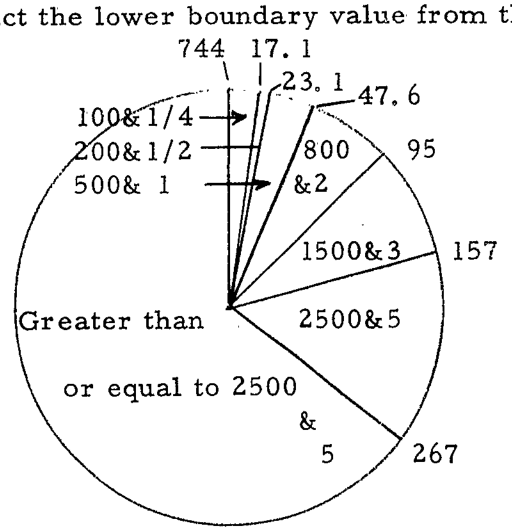
SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH-DOT CURVE: Mean pressure altitude.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for August showing the percentage of time below indicated minimums at each hour of an average day:

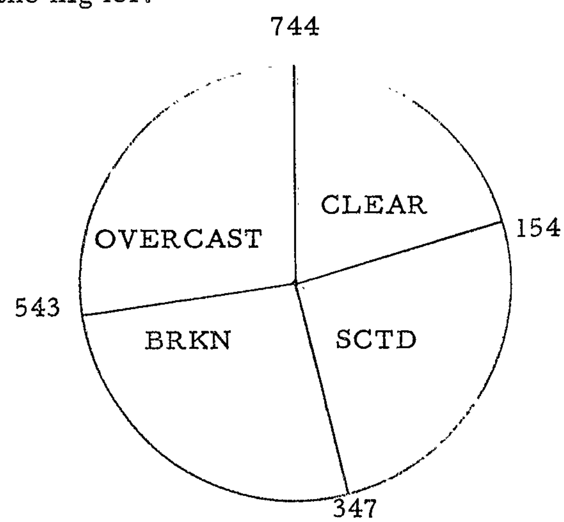


AVERAGE HOURLY FLYING WEATHER FOR AUGUST
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve = less than 200 feet and/or 1/2 mile.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: Although the frequency of low visibilities is higher in August than in July, the incr·ase is not appreciable. August visibilities are essentially the same as those described in July. The slight increase is probably due in part to reduced visibilities accompanying tropical storms or hurricanes which begin to effect the McGuire area during late summer.

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	28.3
Precipitation	1.5
Smoke and/or haze	0.0
Blowing snow and/or dust	0.0

PRECIPITATION: As July, August is a typical summer month with the majority of precipitation being caused by showers. In the summer, McGuire averages slightly over two warm frontal passages a month. These frontal passages together with occasional tropical storms moving up along the coast cause periods of pro ›nged continuous rain in contrast to more typical summer showers.

SUMMARY OF AUGUST PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	8.2
Measurable snowfall	0.0

Hours per month of:

Rain and/or drizzle	52.8
Snow and/or sleet	0.0
Thunderstorms	11.[illegible]
Freezing rain	0.0

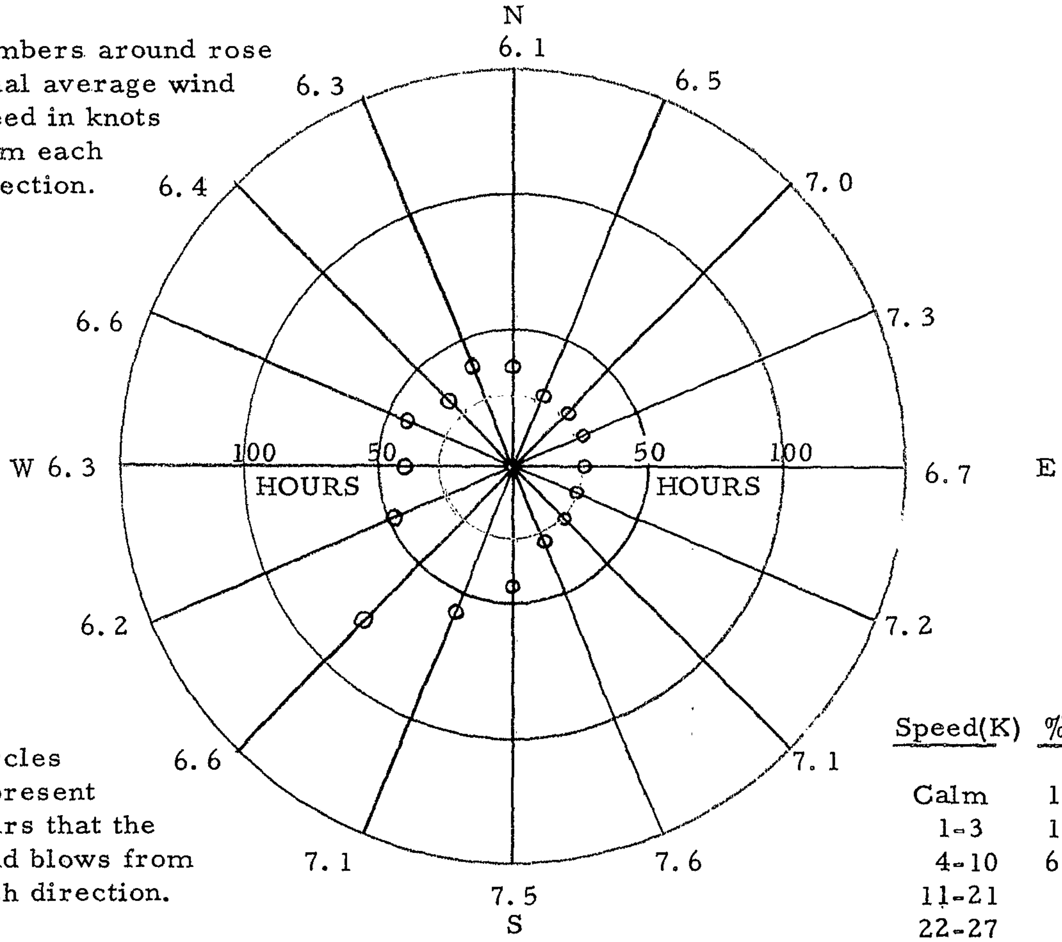
Inches of:

Mean monthly precipitation	4.43
Mean monthly snowfall	0.0

SURFACE WINDS: Thunderstorm activity reaches its peak in August, also, we may expect to be influenced by one hurricane during this month. Erratic convective gusts generally shift in direction as well as speed and are not reflected in the following statistics. Below is a wind rose for August showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR AUGUST

Numbers around rose equal average wind speed in knots from each direction.



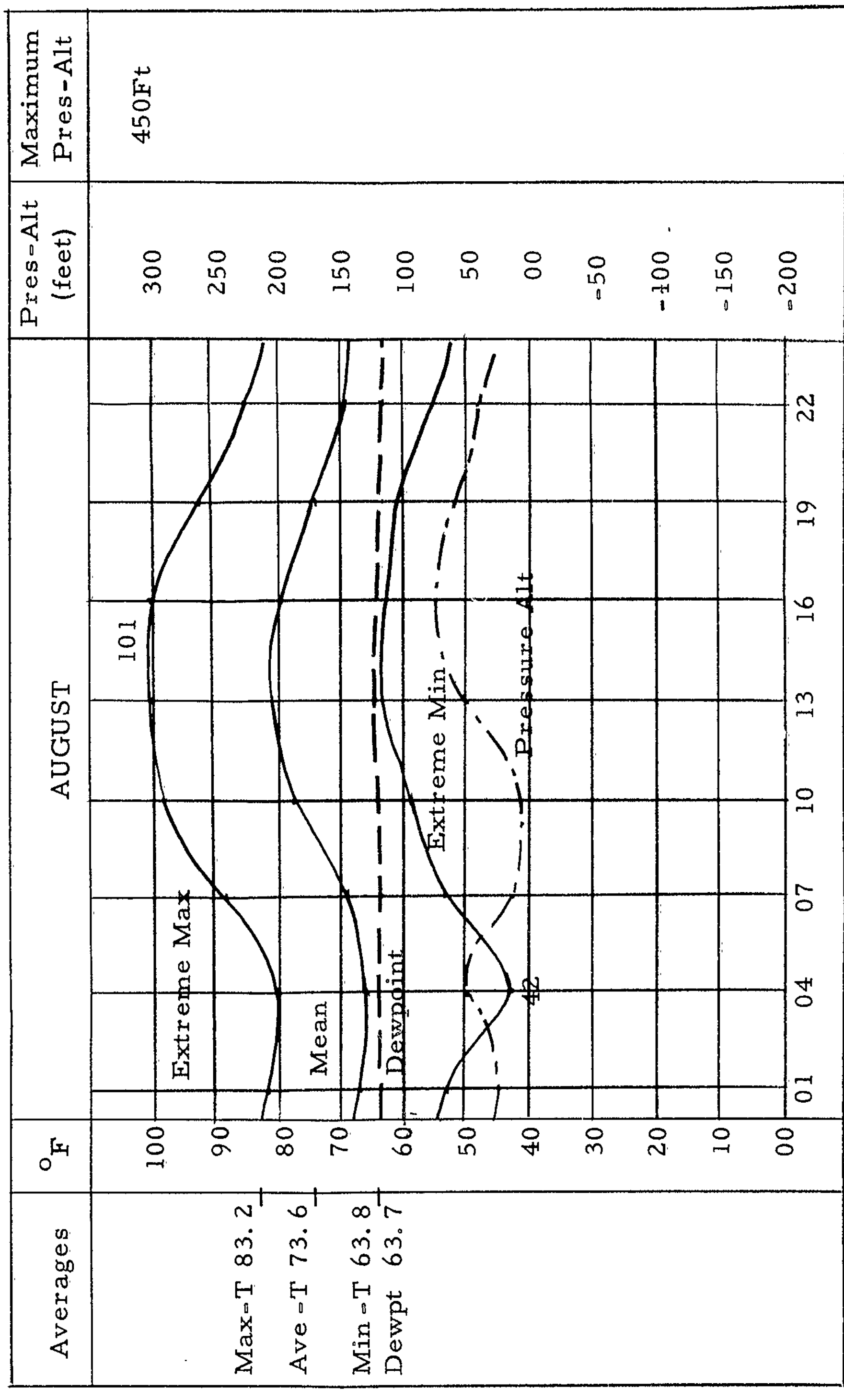
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	17. 1
1-3	13. 3
4-10	62. 4
11-21	7. 0
22-27	0. 1
28-40	0. 1

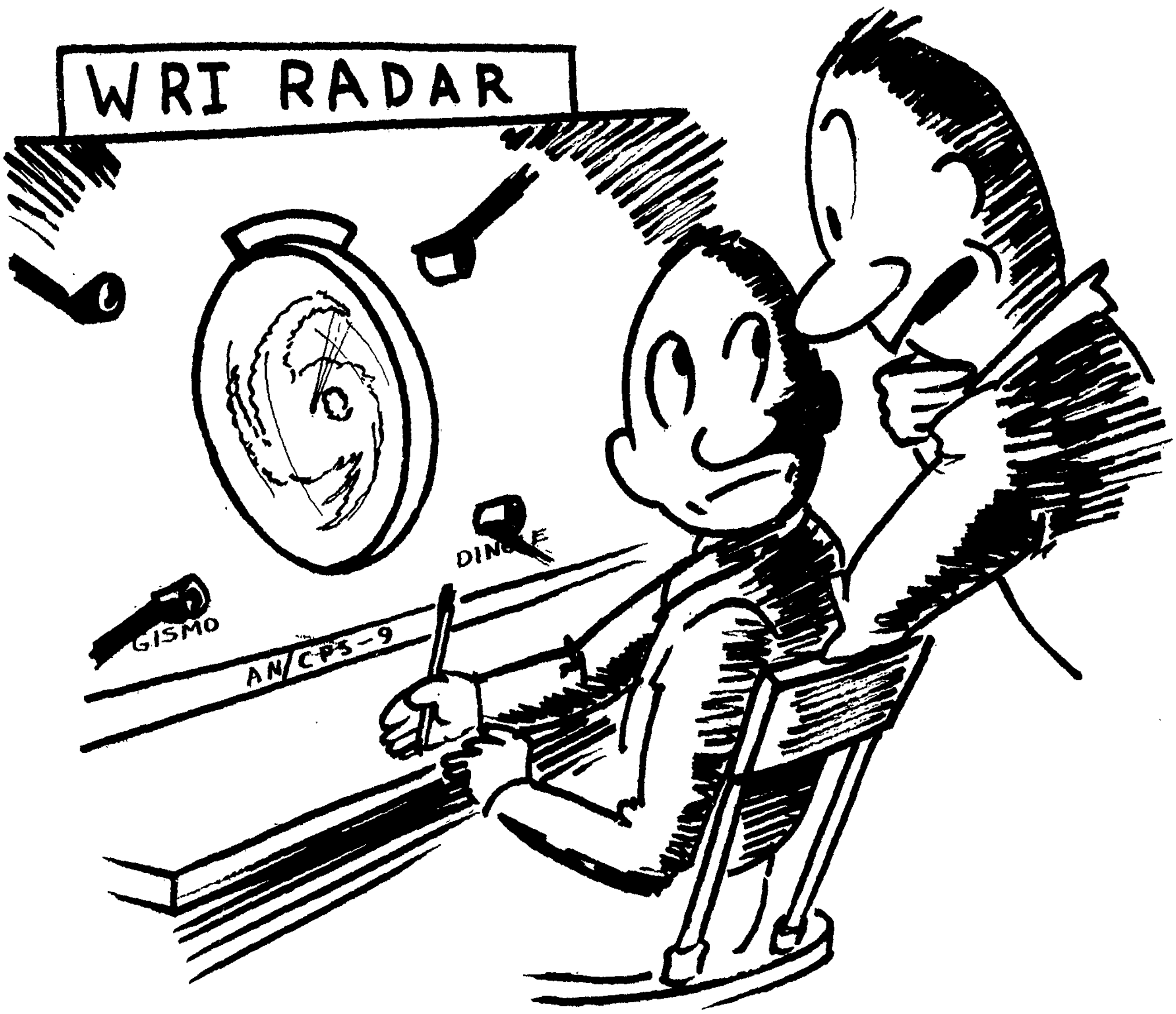
Prevailing wind direction . . . . SW
Mean wind speed (knots) 5. 6
Wind 4 knots or over (percent) 69. 5
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 0. 0
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 24

TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH - DOT CURVE: Mean pressure altitude.



"WHADDAYA SAY WE JUST KEEP IT UNDER OUR HATS"

A FALL WEATHER OUTLOOK FOR McGUIRE AIR FORCE BASE

GENERAL: During the fall the warm Bermuda high gives way to the building continental polar high. Surface winds become more westerly and increase from an average steady speed of 7.3 mph in September to 9.0 in November; the average temperature drops from an average of 66 in September to 45 in November. Typical winter cyclonic activity increases as evidenced by the average number of frontal passages which increases from 8 in July to over 12 in November. But during this transition period, shower activity has noticeably decreased and storminess associated with the winter cyclones and fronts is not yet well developed. Accordingly, fall has the reputation of being one of the periods of generally good weather. The average cloud cover is less during fall than during any other season.

MONTHLY BRIEFS:

September: This is still essentially a summer month. Temperatures are decreasing; however, temperatures over 100 degrees are still possible while temperatures below 36 degrees have never been observed. The chance of thunderstorms is only 1/3 that of August. This month represents the peak of the hurricane season.

October: This is perhaps the most pleasant month. The average cloudiness and the number of days with precipitation is a minimum. The highest temperature ever recorded is 85 degrees while the lowest is 26 degrees.

November: Winter begins with November. Although infrequent, snowfalls of over two inches have occured. An average of 11 days have temperatures below freezing. The number of days with precipitation is increasing as is the frequency of below minimum field conditions.

A FALL WEATHER OUTLOOK FOR McGUIRE AIR FORCE BASE

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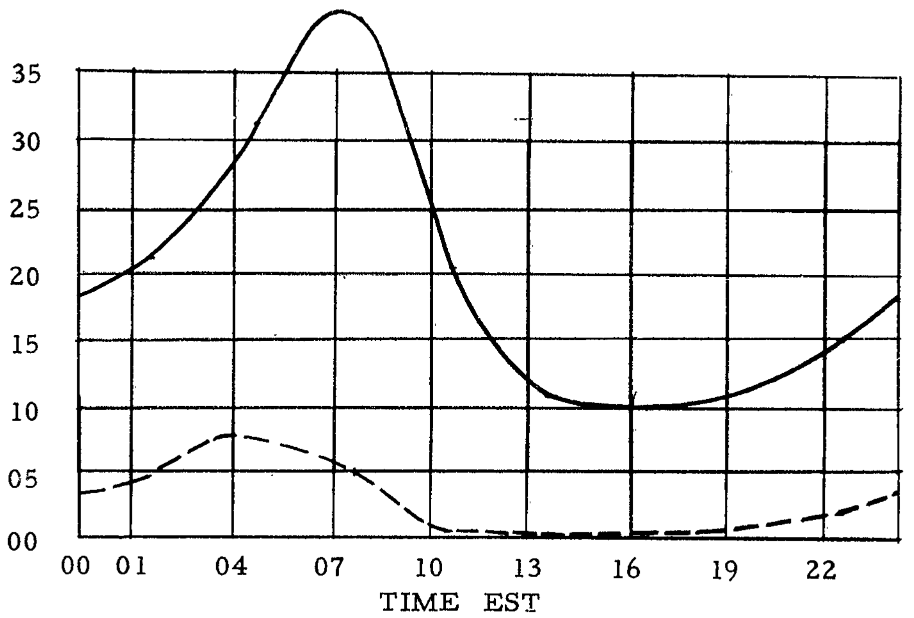
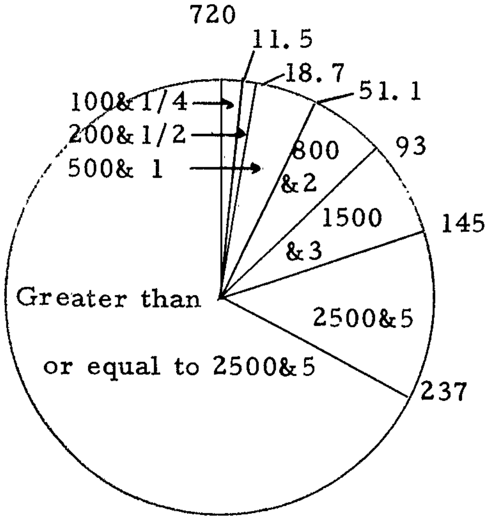
November: Winter begins with November. Although infrequent, snowfalls of over two inches have occured. An average of 11 days have temperatures below freezing. The number of days with precipitation is increasing as is the frequency of below minimum field conditions.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for September showing the percentage of time below indicated minimums at each hour of an average day:

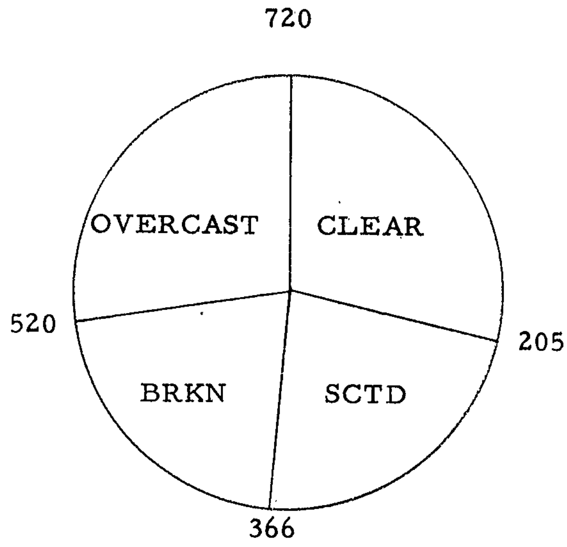


Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve = less than 200 feet and/or 1/2 mile.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: September is in most respects similar to the summer months. Radiation fog is the primary cause of reduced visibilities which occur with a high frequency in the early morning hours and improve rapidly by mid morning. There is a gradual increase in fog and low visibility frequency again due in part to tropical storms or hurricanes which have their highest frequency of occurrence in September.

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	30.2
Precipitation	1.4
Smoke and/or haze	0.0
Blowing snow and/or dust	0.0

PRECIPITATION: During September there is a marked decrease in thunderstorms and shower activity. Both the number of days with precipitation and the precipitation amount decrease during September.

SUMMARY OF SEPTEMBER PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	7.8
Measurable snowfall	0.0

Hours per month of:

Rain and/or drizzle	59.1
Snow and/or sleet	0.5
Thunderstorms	2.9
Freezing rain	0.0

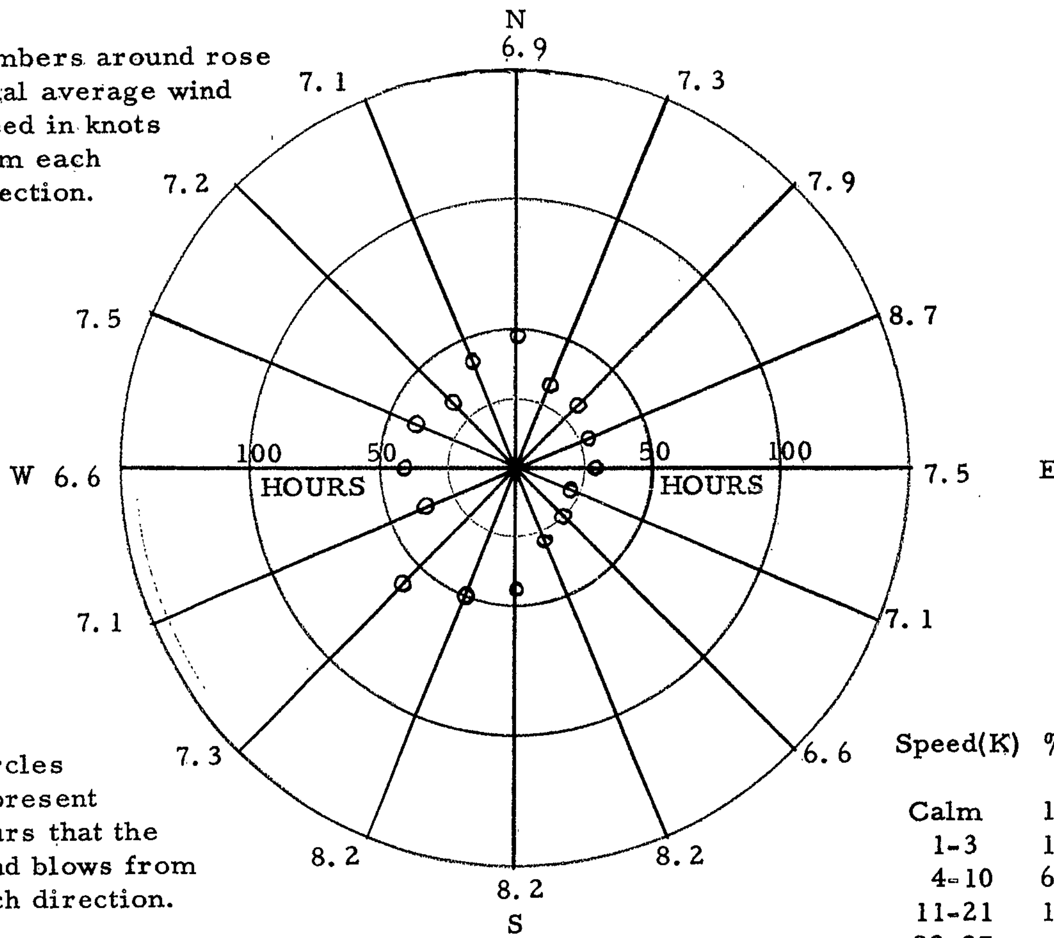
Inches of:

Mean monthly precipitation	3.00
Mean monthly snowfall	0.0

SURFACE WINDS: September shows a 75% drop in thunderstorm activity and associated gusts; however, it is also our hurricane maximum. Therefore, prolonged periods of very strong easterly winds may occur this month accompanying a possible hurricane. Below is a wind rose for September showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR SEPTEMBER

Numbers around rose equal average wind speed in knots from each direction.



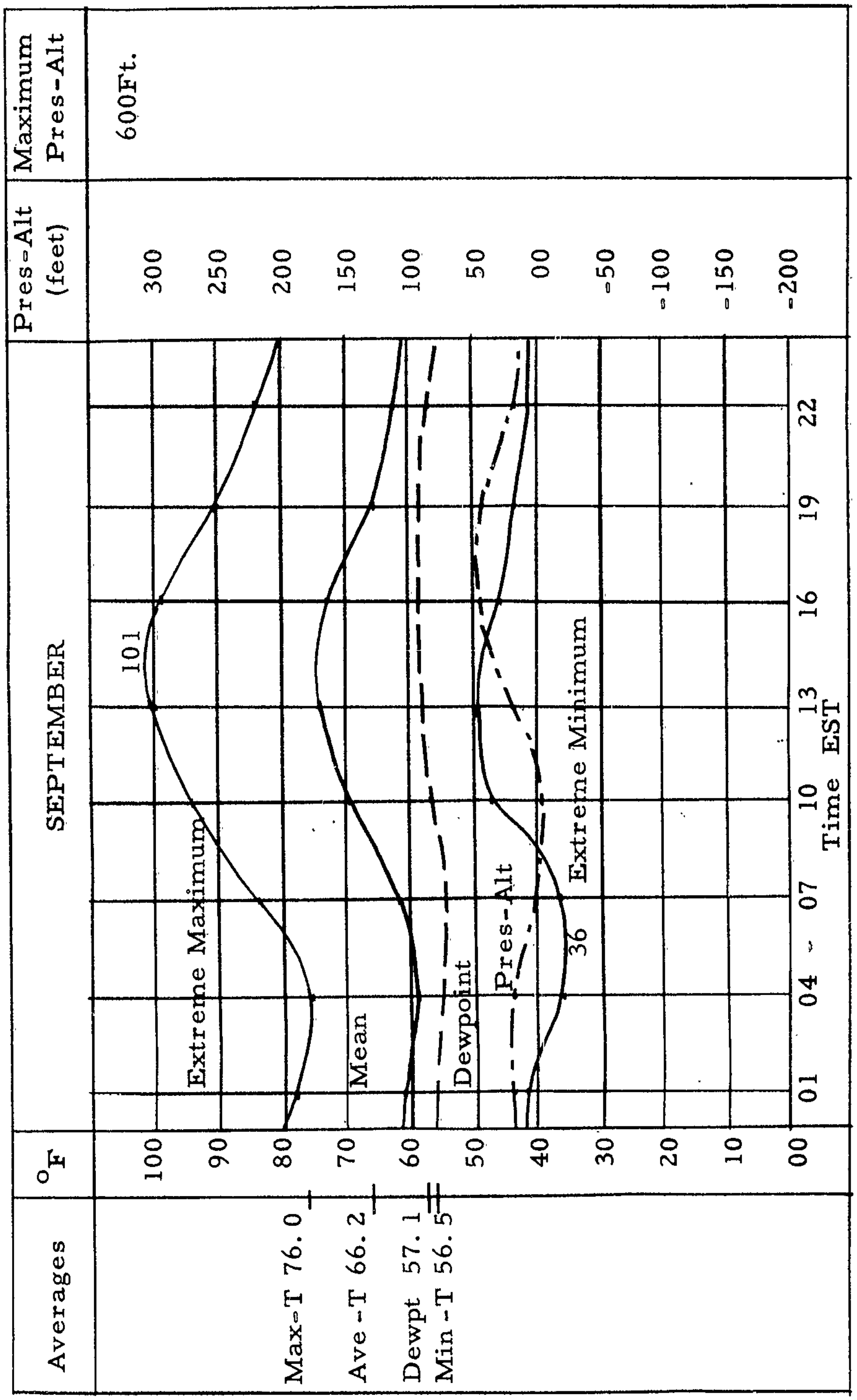
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	16.8
1-3	10.5
4-10	61.5
11-21	10.8
22-27	0.3
28-40	0.0

Prevailing wind direction . . . . SW
Mean wind speed (knots) 6.2
Wind 4 knots or over (percent) 72.6
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 0.7
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 32

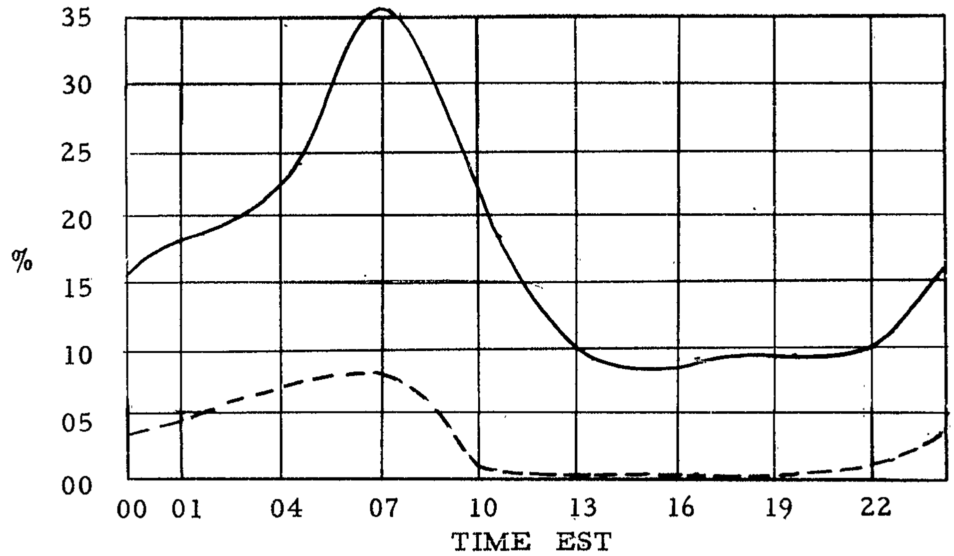
TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



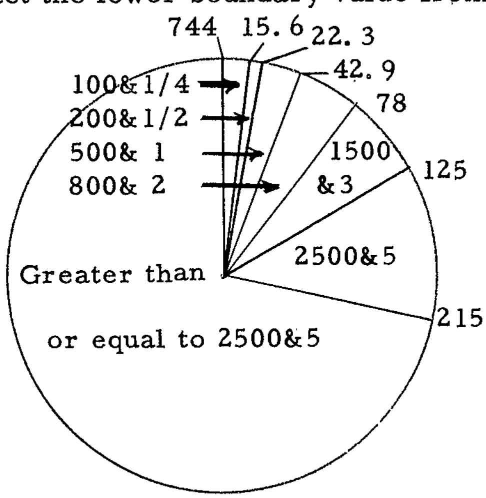
SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH - DOT CURVE: Mean pressure altitude.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for October showing the percentage of time below indicated minimums at each hour of an average day:

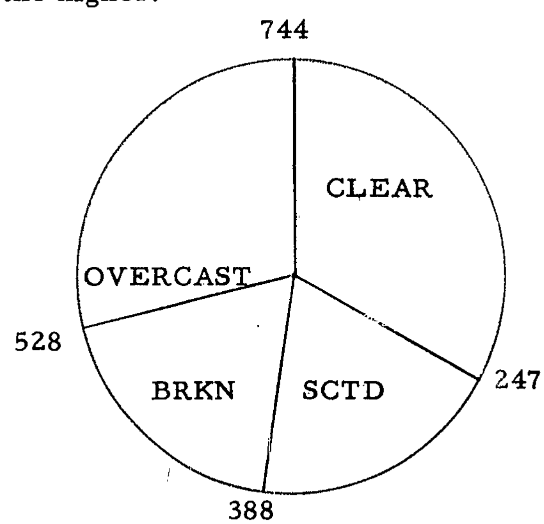


AVERAGE HOURLY FLYING WEATHER FOR OCTOBER
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve - less than 200 feet and/or 1/2 mile.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: With the approach of winter conditions frontal storms and Hatteras lows occur in greater numbers causing periods of advection fog born inland to McGuire by moist Easterly winds. Fog and reduced visibilities are slightly more frequent than during September. Radiation fog continues to be the primary source of reduced visibilities in October, but the thicker and more widespread advection fog now begins to cause prolonged periods of reduced visibilities.

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	32.0
Precipitation	1.5
Smoke and/or haze	0.7
Blowing snow and/or dust	0.0

PRECIPITATION: The number of days with precipitation is lower during October than during any other month. The amount of precipitation is slightly increased over September as a result of increasing frontal activity (there is an average of 8 frontal passages in September compared to 9 1/2 during October).

SUMMARY OF OCTOBER PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	7.3
Measurable snowfall	0.1

Hours per month of:

Rain and/or drizzle	66.3
Snow and/or sleet	0.5
Thunderstorms	1.5
Freezing rain	0

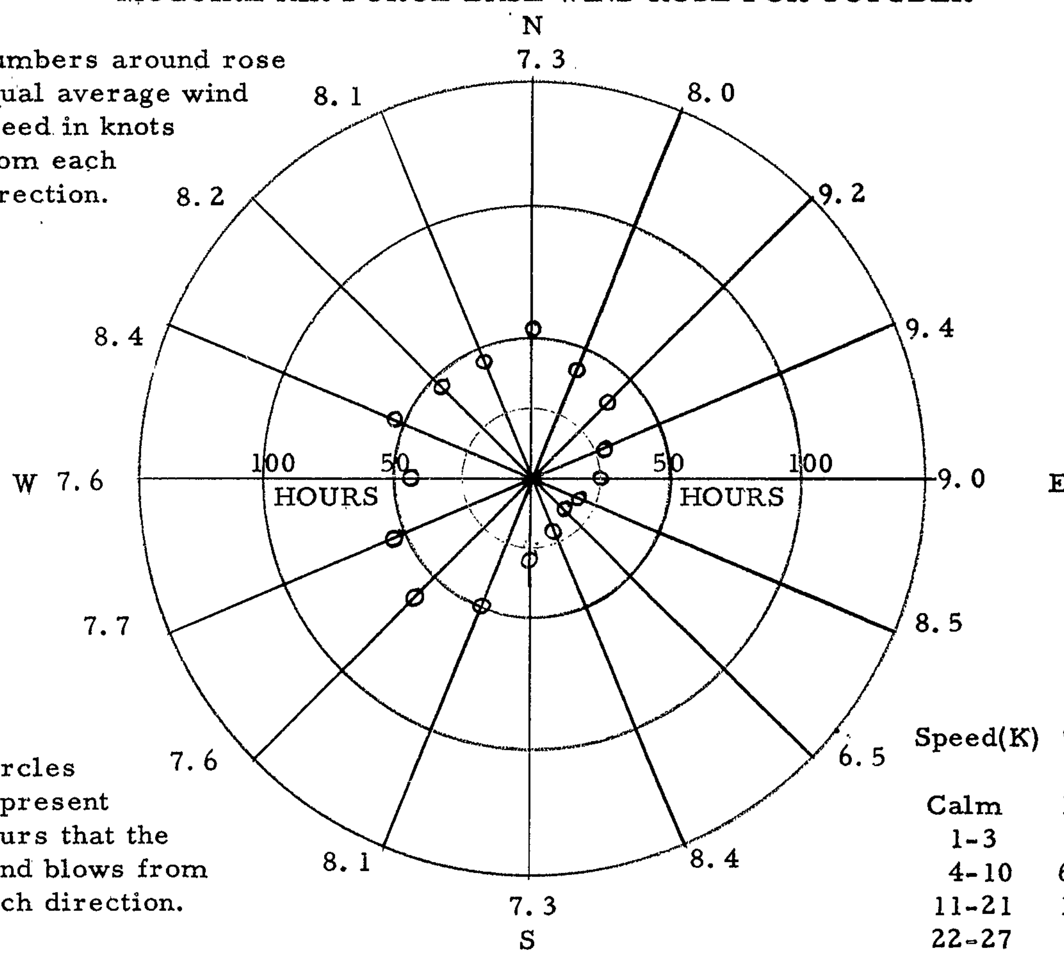
Inches of:

Mean monthly precipitation	3.26
Mean monthly snowfall	Trace

SURFACE WINDS: October is another transition month, exhibiting an increase of winter-type wind activity. The presence of colder air tends to tighten the pressure gradients; convective activity decreases; and one hurricane may influence our area. Below is a wind rose for September showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR OCTOBER

Numbers around rose equal average wind speed in knots from each direction.



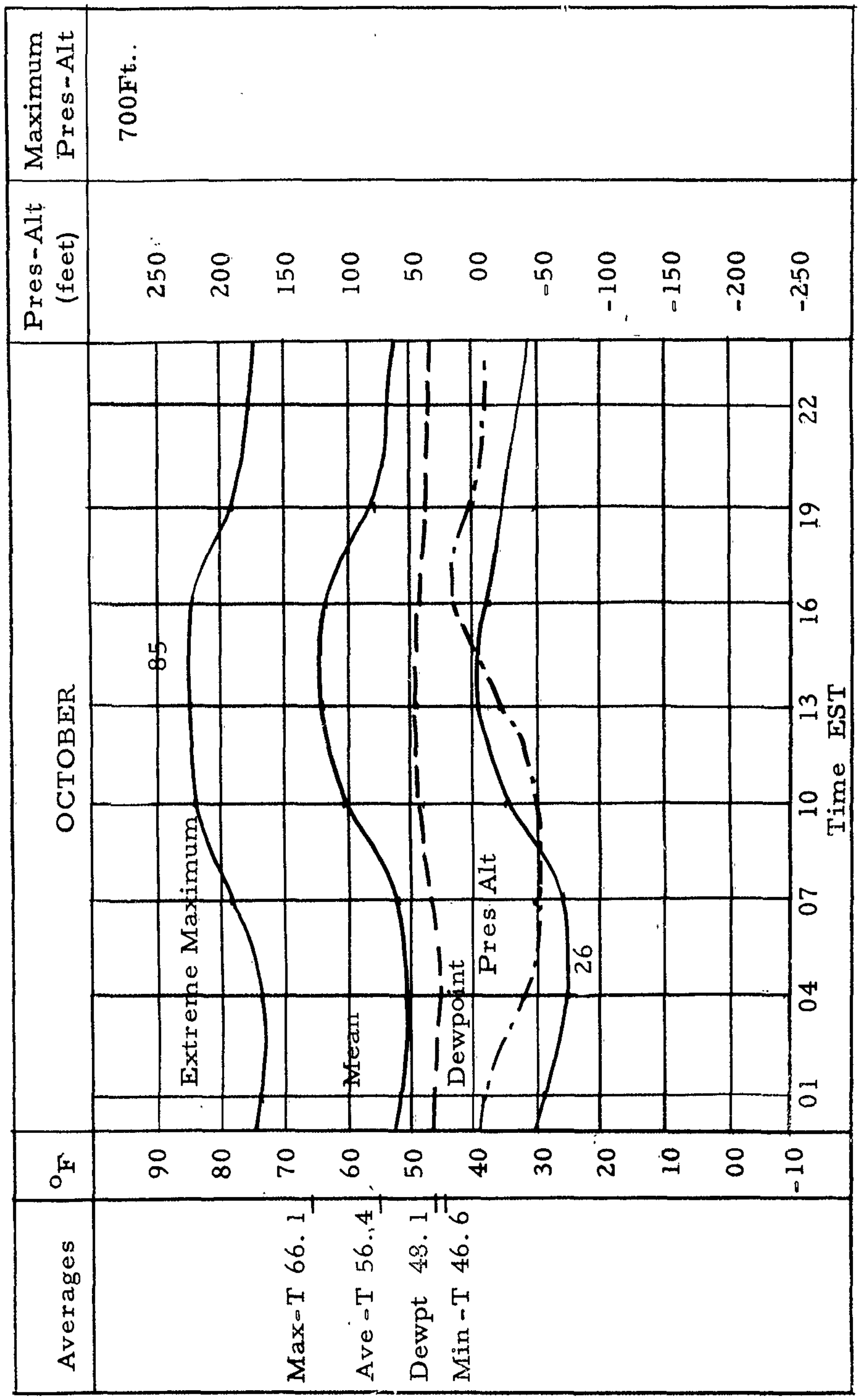
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	15.3
1-3	8.2
4-10	60.2
11-21	15.2
22-27	0.4
28-40	0.1

Prevailing wind direction . . . . SW
Mean wind speed (knots) 6.8
Wind 4 knots or over (percent) 76.5
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 1.5
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 51

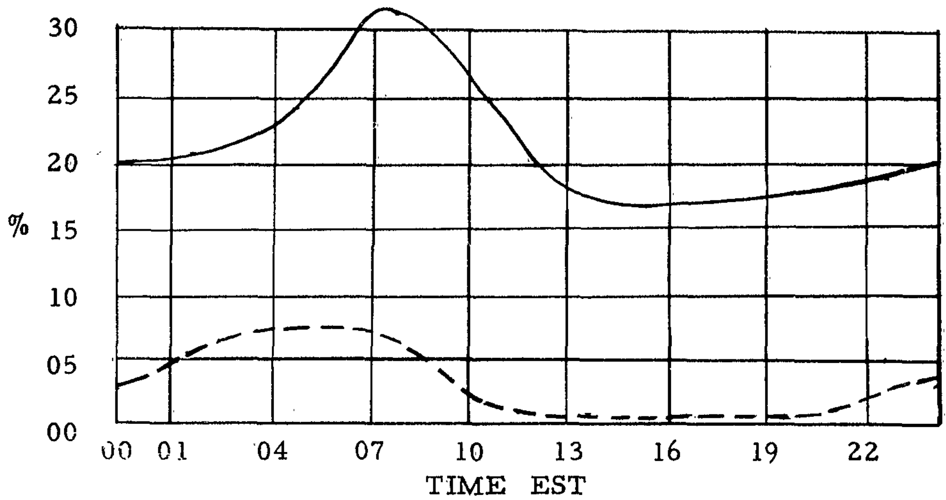
TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



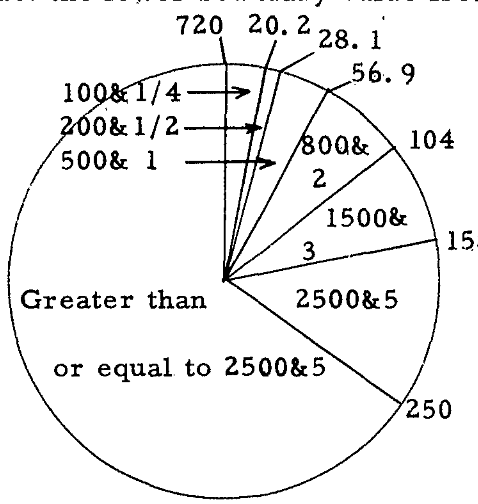
SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH - DOT CURVE: Mean pressure altitude.

FLYING CONDITIONS: Following is a graphic depiction of the average hourly flying weather for November showing the percentage of time below indicated minimums at each hour of an average day:

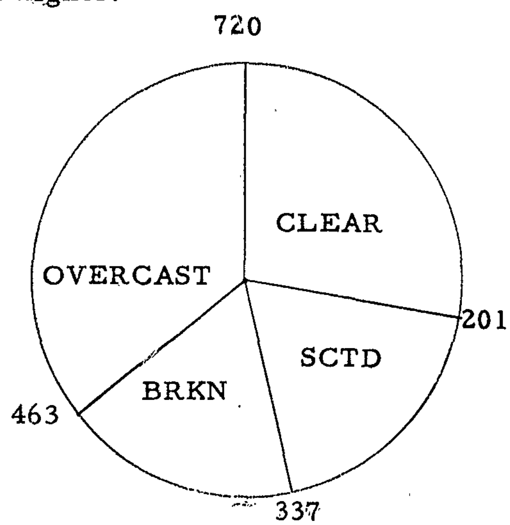


AVERAGE HOURLY FLYING WEATHER FOR NOVEMBER
Solid curve represents conditions less than 1500 feet and/or 3 miles; dashed curve - less than 200 feet and/or 1/2 mile.

To further examine the ceiling and visibility categories, the pie diagrams below show the total hours per month of various significant operational minimums and sky conditions. To find the total hours for any one category, subtract the lower boundary value from the higher.



HOURS BELOW VARIOUS MINIMUMS



SKY CONDITION (HOURS)

VISIBILITY: Although visibilities tend to improve 1 - 2 hours after sunrise, the rate of improvement is far less rapid than during the warmer months. By the end of November, the weather at McGuire becomes typical winter type. Prolonged periods of low visibilities often occur in conjunction with warm fronts or low pressure systems moving toward McGuire from the south.

HOURS WITH VISIBILITY LESS THAN ONE MILE DUE TO:

Fog	33.2
Precipitation	3.6
Smoke and/or haze	2.9
Blowing snow and/or dust	0.0

PRECIPITATION: With the steady increase in frontal storminess, both the amount and duration of precipitation increases during November. The average number of frontal passages is a maximum (13) at McGuire during November. Since most of these fronts move through the area rapidly, the resulting poor weather is not as pronounced as it is during the colder winter months when the storms are more developed and influence the local area for longer periods.

SUMMARY OF NOVEMBER PRECIPITATION STATISTICS:

Mean number of days with:

Measurable precipitation	9.2
Measurable snowfall	0.4

Hours per month of:

Rain and/or drizzle	78.5
Snow and/or sleet	9.4
Thunderstorms	0.0
Freezing rain	0.0

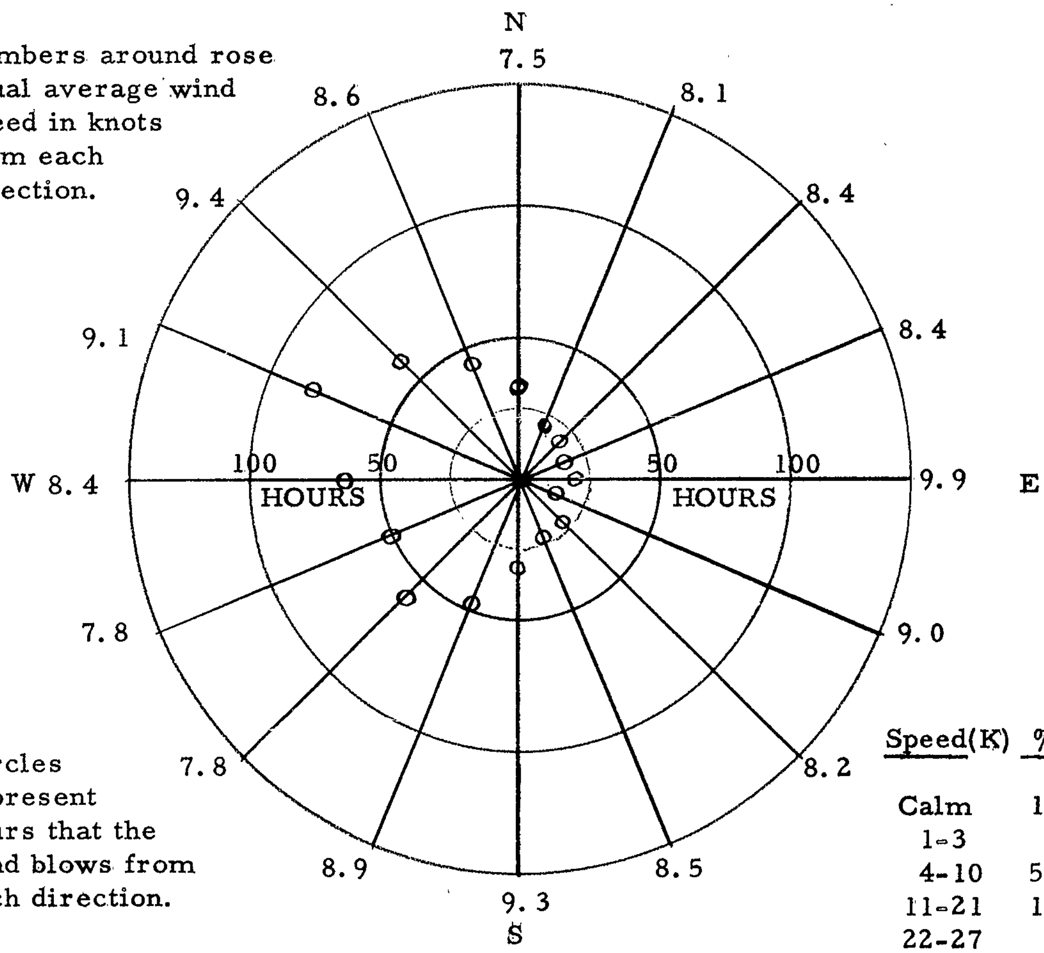
Inches of:

Mean monthly precipitation	3.66
Mean monthly snowfall	1.5

SURFACE WINDS: With winter nearly here, surface winds begin to shift back to the northwest and intensify due to the dominance of cold, polar air masses. Surface turbulence and increasing cross-wind conditions become the major problems as opposed to the erratic gusts of summer. Below is a wind rose for November showing the average wind speeds and the hours per month of prevailing winds from 16 points of the compass.

MCGUIRE AIR FORCE BASE WIND ROSE FOR NOVEMBER

Numbers around rose equal average wind speed in knots from each direction.



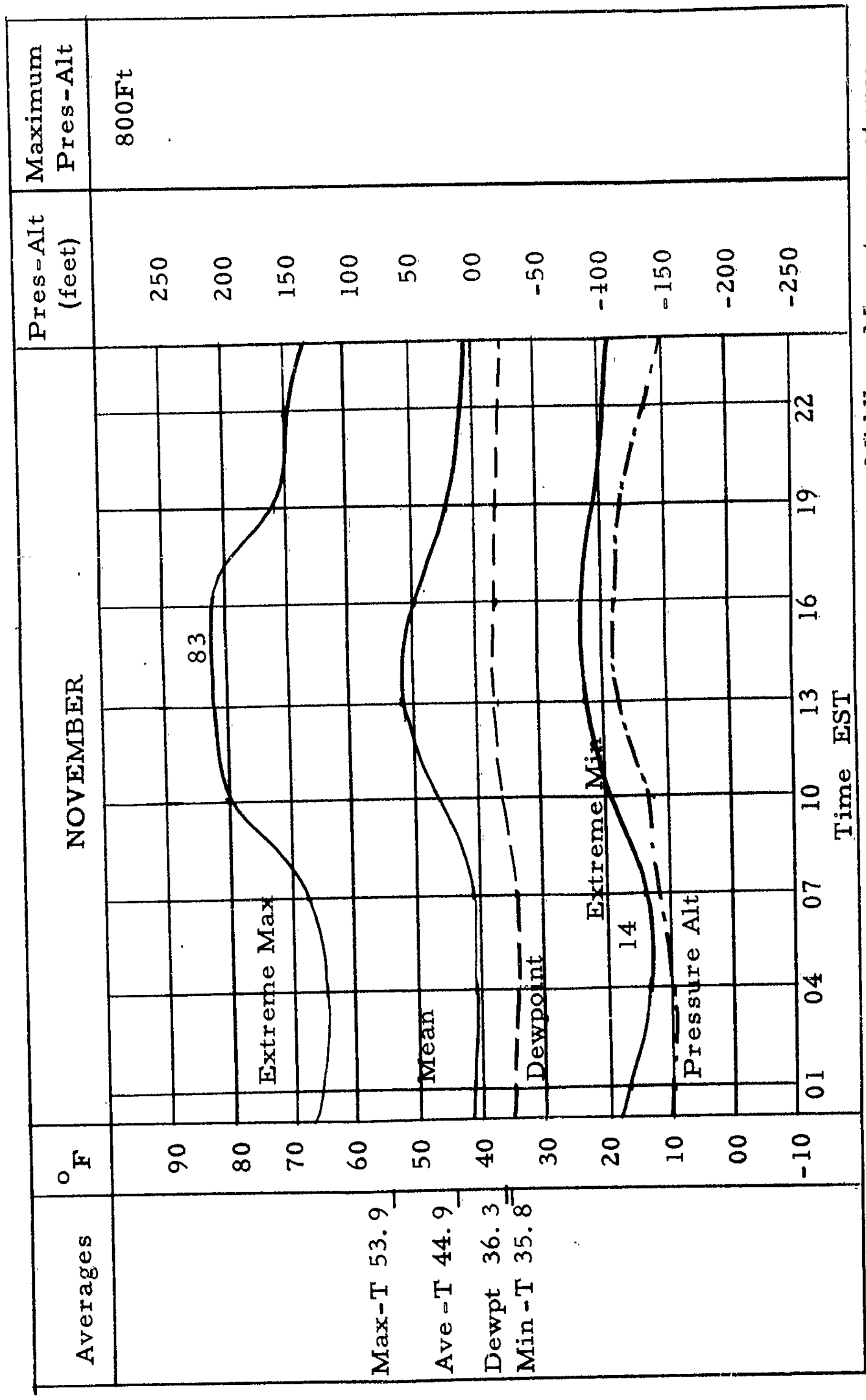
Circles represent hours that the wind blows from each direction.

Speed(K)	%
Calm	15.0
1-3	9.3
4-10	54.9
11-21	19.6
22-27	0.9
28-40	0.2
41K plus	0.1

Prevailing wind direction . . . . WNW
Mean wind speed (knots 7.3
Wind 4 knots or over (percent) 75.6
Hours/month with greater than 20K cross-wind on runway 06-24 . . . 5.8
Hours/month with greater than 10K cross-wind on runway 06-24 . . . 97

TAKE-OFF AND PERFORMANCE DATA: For aid in operational planning, the following take-off and performance data are presented.

TEMPERATURE, DEWPOINT AND PRESSURE ALTITUDE SUMMARY BY HOURS



SOLID CURVES: Upper - Extreme maximum temperature; Middle - Mean temperature; Lower - Extreme minimum temperature. DASHED CURVE: Mean dewpoint. DASH - DOT CURVE: Mean pressure altitude.

A. Objective Studies

(1) An Objective Study for Forecasting Morning Visibilities at McGuire AFB, N. J.

(2) An Objective Study for Forecasting Morning Sky Conditions at McGuire AFB, N. J.

(3) An objective method of forecasting the dissipation time of stratus.

AN OBJECTIVE STUDY

FOR

FORECASTING MORNING VISIBILITIES AT

McGUIRE AFB, N. J.

MARCH 1960

BY

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AND

LT. PIAVE CORRADI

DETACHMENT 22

9TH WEATHER GROUP (MATS)

UNITED STATES AIR FORCE

McGuire Air Force Base, New Jersey

FORECASTING MORNING VISIBILITIES AT McGUIRE AFB

1. Introduction:

This study supersedes the three previous visibility studies prepared by McGuire. Techniques and correlations of the earlier studies might be of interest for research purposes, but all significant operational results are incorporated into this study.

2. Operational Weather and Time Limits:

The 2100E (0200Z) local observation is used to make a forecast of the visibility for the ensuing time-period. The time of forecast (2100E) coincides with the issuance of the McGuire TAFOR at 2200E which is an important operational forecast for the following morning. The valid time of the objective visibility forecast (0000E - 1000E) is the period of the day that visibilities are generally lowest and most critical.

3. Precise Statement of Problem:

a. The study is designed to answer three operational questions:

(1) What will be the lowest visibility at McGuire during the period 0000E - 1000E?

(2) What time will this visibility occur?

(3) How long will it last?

b. A secondary objective of the study is to present the graphs, tables and worksheet in a combined and simplified form to minimize cross referencing and to facilitate daily or monthly evaluation.

*"An Objective Aid for Forecasting Low Visibilities at McGuire During Oct., Nov., and Dec., 1955"
"An Objective Technique for Forecasting Visibilities Below 3 Miles, 1958
"An Objective Technique for Forecasting Morning Visibilities at McGuire" Feb

4. Data Collected and Analyzed:

One year of new data (December 1958 thru November 1959) was used to refine the study of February 1959.

Three months of independent data (Dec 1959 thru Feb 1960) were held for evaluation.

5. Predictors Selected and Evaluated:

Parameters tested that had not been investigated in previous studies are:

(1) 4-Hour temperature change (1700-2100E).

(2) Total sky cover.

(3) Ceiling.

The current (2100E) visibility and 24-hour factor change are again evaluated.

6. Procedure:

Since its completion the February 1959 study has been used and evaluated daily by Detachment 22, 9th Weather Group. It was noted that the method would often fail to forecast low visibilities resulting from radiation type fog or precipitation. Thus parameters were choosen in hopes of accounting for radiational effects. The precipitation effect seemed too complex to solve for the relatively few cases involved.

Graphs I and II of the previous study which include the parameters of wind direction, speed and temperature dew point spread were not altered. These predictors have consistently proven to be significant. (A study, by the MELPAR Research Center, Cambridge, Mass., dated 1958, utilized machine methods in attempting to derive an objective short range visibility forecast for McGuire. Best results were obtained with local wind, spread and visibility observations while little or no significance was noted for upper air or surrounding station data)

Scatter plots of verifying visibility were made using factor #2 (obtained thru graphs I and II mentioned above) vs the new and reevaluated predictors. The following relations were noted:

(1) A nearly linear correlation of lowest visibility (0000E-1000E) to observed visibility (2100E).

(2) No significant relation to ceiling.

(3) A variation of visibility in clear vs cloudy sky conditions.

(4) A variation of visibility with temperature changes over 10° vs less then 10°.

(5) Only a slight variation with 24 hour factor change.

Three radiation types were defined:

(1) Type A: Clear, Scattered or High Broken Clouds with a 4 hour temperature change over 10°.

(2) Type B: Clear, Scattered or High Broken Clouds with a 4 hour temperature change less than 11°.

(3) Type C: High overcast or a ceiling below 20000 feet.

The data was then separated into 3 types and individual scatter plots of verifying visibility were constructed using factor #2 vs observed (2100E) visibility. Isopleths of lowest visibility were then drawn for each plot. The combined results are contained in graph 3.

7. <u>Verification:</u>

Verification utilizing 3 months of independent data is shown in the following contingency table. The skill score of .50 represents an improvement over the February 1959 study which was .43.

	Forecast			
Observed	G	I	V_L	V_H
G	6	2	2	0
I	2	11	3	5
V_L	0	3	7	7
V_H	1	2	3	37

G $<1/2$

I $\geq 1/2$ 3

V_L ≥ 3 ≤ 5

V_H >5

Skill Score .50

Forecast Correct 67

8. Time and Duration of Lowest Visibility:

a. No further investigation was made of the results of the previous study. These are summarized as follows:

(1) Mean (or mid) times of lowest visibility are:

February - 0700E

May - 0600E

August - 0500E

November - 0700E

(2) Average length of time that a visibility will remain low (ie: within the G, I, or V_L categories) is 3 hours.

(3) Example: If the lowest visibility forecast is 1/2 mile in February. The forecast should call for visibility below 1/2 mile from 0530 to 0830E. No conclusion can be made for the visibility before 0530 or after 0830E.

9. Method of Application:

a. All necessary graph references and data tabulations are contained in Figure I which contains space for a full month of record.

b. Steps:

(1) Tabulate the 2100E observation (includes: wind direction, velocity, temperature, dew point, visibility, sky cover, and the 1700E temperature.

(2) Determine the radiation type (A, B or C).

(3) Enter Graph I with wind direction and velocity and list factor #1.

(4) Enter Graph II with factor #1 and the temperature--dewpoint spread and list factor #2.

(5) Enter Graph III with factor #2 and the 2100E visibility and read visibility according to type.

(6) List this visibility which is the forecast lowest visibility for the ensuing period 0000E to 1000E.

(7) Determine the time and duration of lowest visibility which is explained in Section 8 above.

(8) Modify for frontal passages or expected precipitation.

10. Limitations of Study:

The inclusion of radiational factors improved the forecasts particularly those below 1 mile; however, in the verification 4 cases of visibilities below 1/2 mile occurred that had not been forecast. Two of these were caused by precipitation (Type C) and two by radiation fog (Type A).

Three forecasts of less than 1/2 mile were made that did not verify. These were all post frontal situations where rapidly improving conditions occurred.

The compact worksheet and the simplicity of its use are particularly desirable features of the study.

LOWEST VISIBILITY FORECAST (0500Z - 1500Z) Month/Year ________

Date	0200Z (2100E) OBSERVATION						FACTOR		FCST & VERIF.			
Z	dd/ff	TT/TT	SKY	TT	Type	VV	#1	#2	OBJ	TAF	VRF	RMKS
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
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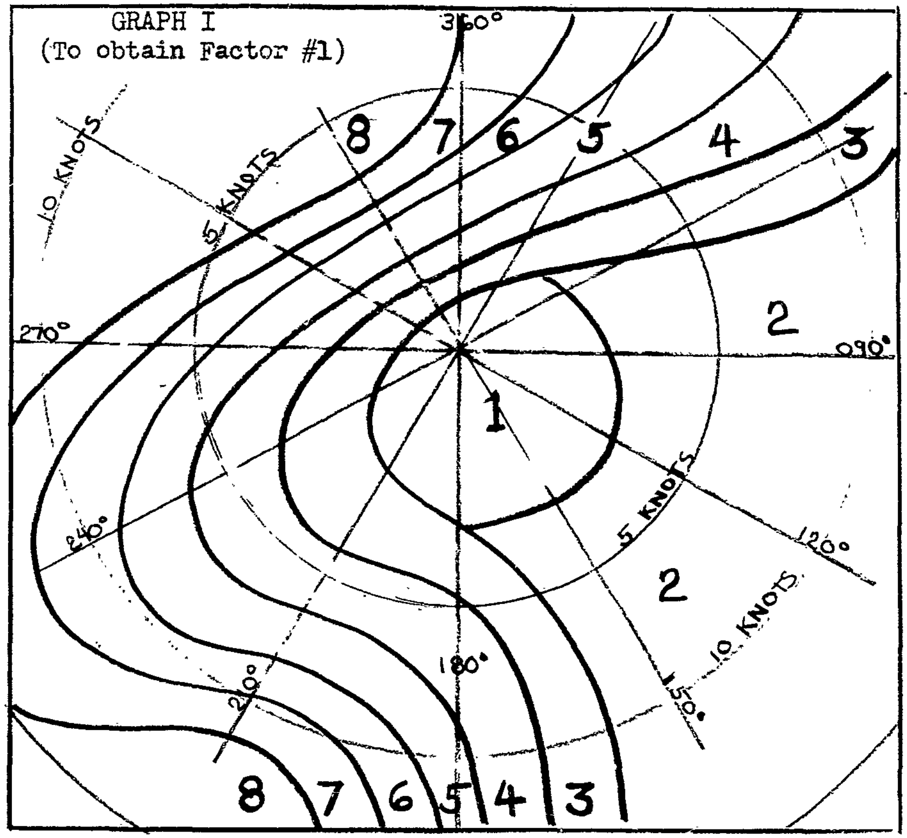
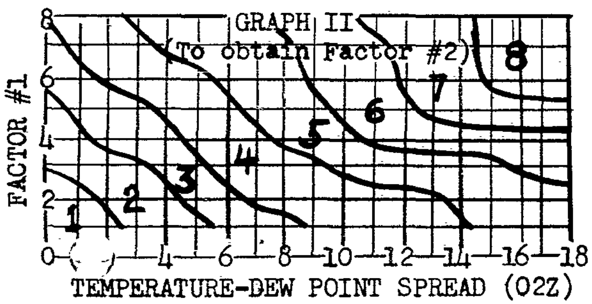
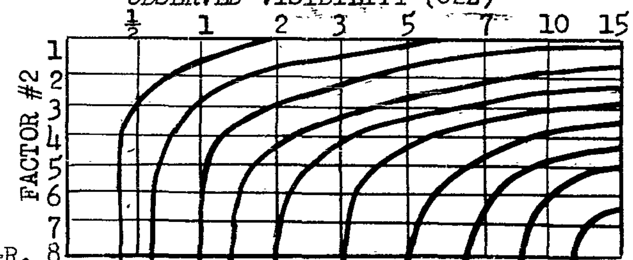




FORECAST THE LOWEST VISIBILITY TO OCCUR FOR THE THREE HOUR PERIOD: ONE HOUR BEFORE-TWO HOURS AFTER SUN-R.



TYPE A: CLR, SCTD or HI BKN &ΔT>10° → ⅛ ¼ ½ 1 2 3 5 6 8 10
TYPE B̄: CLR, SCTD or HI BKN &ΔT<11° → ½ 1 1½ 2 3 4 5 6 10 12
TYPE C̄: HI OV or CIGS below 20000' → ¼ ½ 1 2 3 4 5 6 10

(ΔT is temp at 22Z minus 02Z)

AN OBJECTIVE METHOD OF FORECASTING THE SKY CONDITIONS AT McGUIRE AFB, NEW JERSEY

(Prepared: April 1962)

1. This study is based upon preliminary results of a pilot study currently being evaluated and expanded at McGuire.

2. 0300Z observations are used to make a forecast of the sky condition for the period eight-twelve hours later (1100Z to 1500Z). This forecast period represents the time of day when ceilings are usually most critical.

3. The study is designed to:

a. Indicate the prevailing ceiling (or cloud cover) during the period 1100-1500Z.

b. Indicate the variation in condition between 1100-1500Z which would be a guide to the sky condition after 1500Z.

4. Three months of data (Feb, Mar and Apr 1961) were used to construct the basic graph. This was refined by synoptic reasoning tegether with individual forecaster experience.

5. Parameters tested include:

a. Current (0300Z) local observation of wind, temperature, dewpoint and sky cover.

b. Pressure gradients for 4 surrounding stations.

6. After a few test scatter diagrams were plotted, the striking relation was noted of the pressure gradient between SBY and IDL to the ensuing sky cover at McGuire. The temperature dewpoint spread also showed a relationship. Using the 0300Z observed parameters, the sky conditions for 1100Z and 1500Z

were then plotted and certain areas noted. The areas were smoothed and refined by synoptic reasoning.

7. Verification is currently being accomplished.

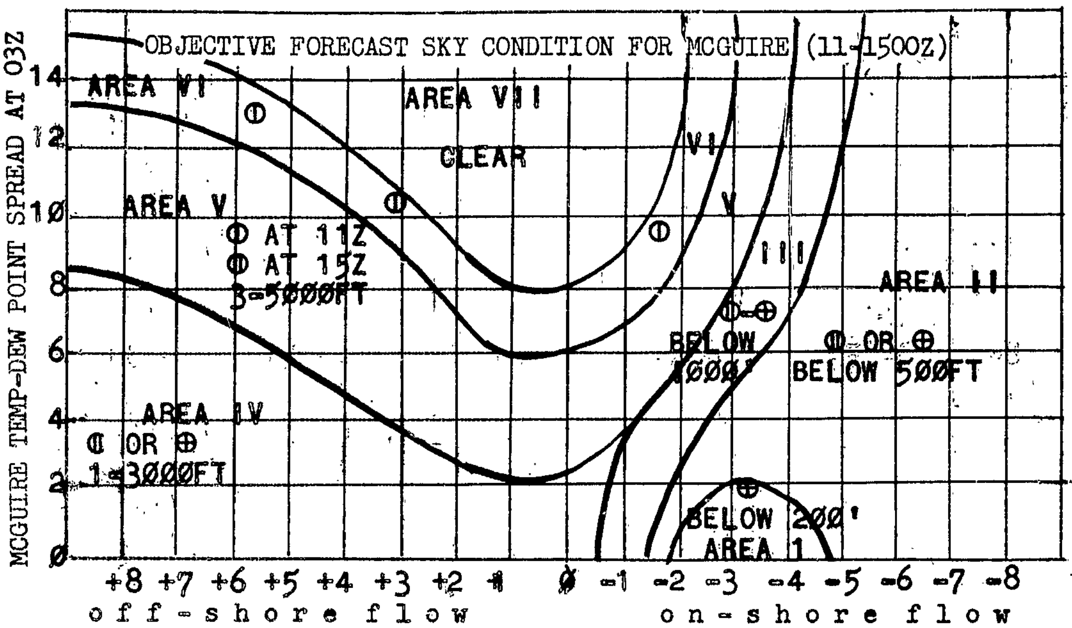
8. To apply the method:

a. Determine the 0300Z temperature-dewpoint spread from the McGuire observation.

b. Determine the pressure difference between Salsbury and Idlewild from the hourly reports (or synoptic chart).

c. Enter the forecast graph with "a" and "b" above and read the forecast for 1100Z-1500Z.

9. The graph is probably most accurate with air mass type weather. In view of the limited data used to construct the forecast graph, no statement concerning its reliability can be made.



DATE	0300Z OBSERVATIONS						VERIFICATION				
Z	TEMP	DEW PT	Δ T	SBY P	IDL P	Δ P	FCST AREA	11Z OBS	15Z OBS	LOWEST	REMARKS
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
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Month/Year ________________

AN OBJECTIVE METHOD OF FORECASTING THE

DISSIPATION TIME OF STRATUS

(Prepared April 1962)

1. This study is based upon a San Francisco fog study (exact reference unknown). The solar heating data and basic empirical formula were supplied by CWO M. Kozak who had used the method with much success on the West Coast as well as in England.

2. The basic method equates the mean solar heating (gram calories per cm^2) received at various times of day against the heat required to dissipate stratus expressed in the empirical formula: $Q = 1.1\,(P_o - P)\,(T - T_o)$ where:

Q: Heat required (gram calories per cm^2)

1.1: An empirical constant

P_o: Pressure at base of stratus layer (mbs)

P: Pressure at top of stratus layer (mbs)

T: Potential temperature at top of stratus (^oC)

T_o: Potential temperature at base of stratus (^oC)

3. To simplify the equation, the following assumptions are made:

a. 1.1 equal 1.0

b. $(P_o - P)$ equal CLOUD THICKNESS (ft)/20

c. $(T - T_o)$ equal 5^oC (a local climatological mean)

4. The equation now becomes: Q=CLOUD THICKNESS/4. With this relationship established, the cloud thickness can be directly equated with solar heating received at various times of day and time of year *to indicate the dissipation time of the stratus layer.

This information is shown on the forecast graph which describes the break time curves for January and July.

5. The graph can be used with more accuracy by using the basic formula (para 2 above) and substituting the resulting Q for 1/4 CLOUD THICKNESS. However inview of the numerous inaccuracies and assumptions that must be employed in obtaining the required variables, it is doubted that this refinement would be significant.

6. TO USE THE METHOD:

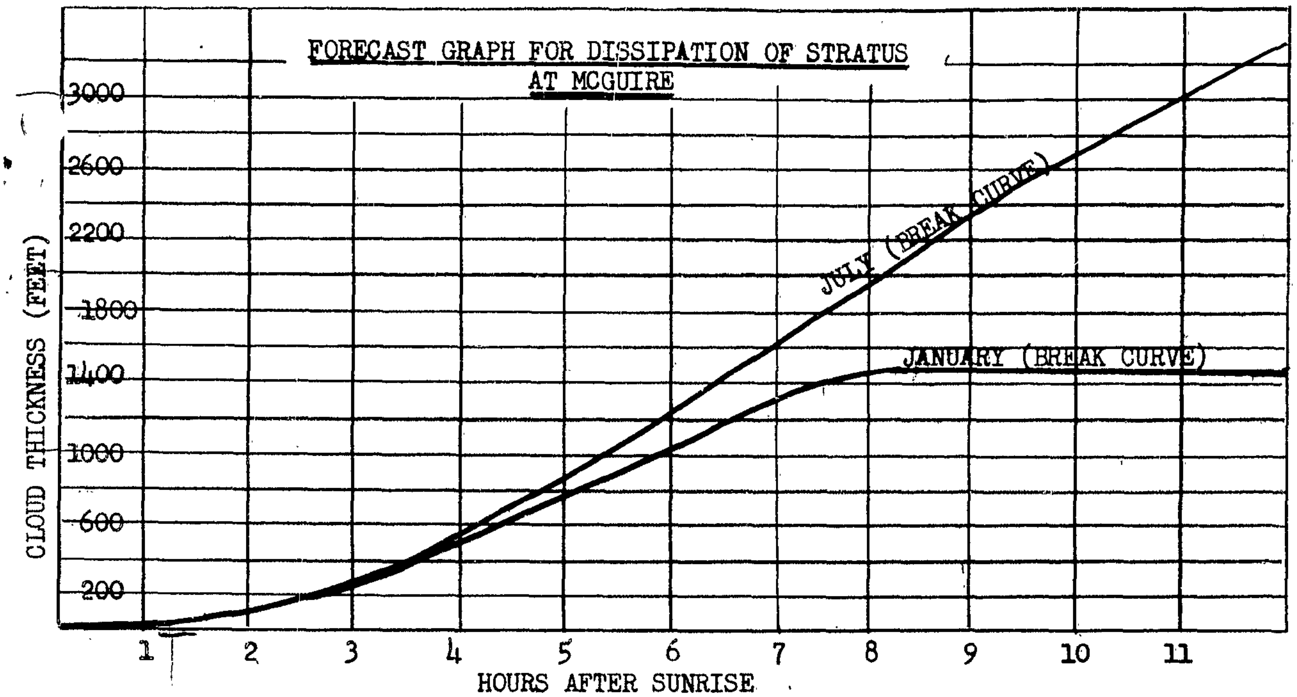
a. Determine the thickness of the stratus at dawn. (By forecast or by PIREP or RAOB observations)

b. Enter the graph with the thickness value and read from the curve (interpolate for months other than January or July) the hours after sunrise that the stratus will break.

c. Modify the result for cloud cover above, thus break time will be delayed if an overcast exists above. And likewise, the break time be earlier if it is clear above.

d. Modify for continued advection of warm air.

*These are fixed values, varying with latitude, time of day and month. These were used in the basic Frisco study and are incorporated into the forecast graph without alteration.



VERIFICATION

Day/Mo	Cloud thickness at sunrise	How Determined	Forecast Break Time	Actual Break Time	WRI OB at Sunrise	Other Sig Obs

B. <u>Special Synoptic Studies</u>

TYPICAL WEATHER TYPES

(1) Gentle Inflow of MTW Air

(2) Intense Cold Front

(3) CPK Outbreak from the Northwest

(4) CP High Moving Off the Middle Atlantic Coast

(5) Warm Front to South With a Wave to the West

(6) Stationary Front to South With Minor Stable Waves

(7) Warm Frontal Passage From the Southwest

(8) MT High Centered Over Bermuda With Southwest Flow over McGuire

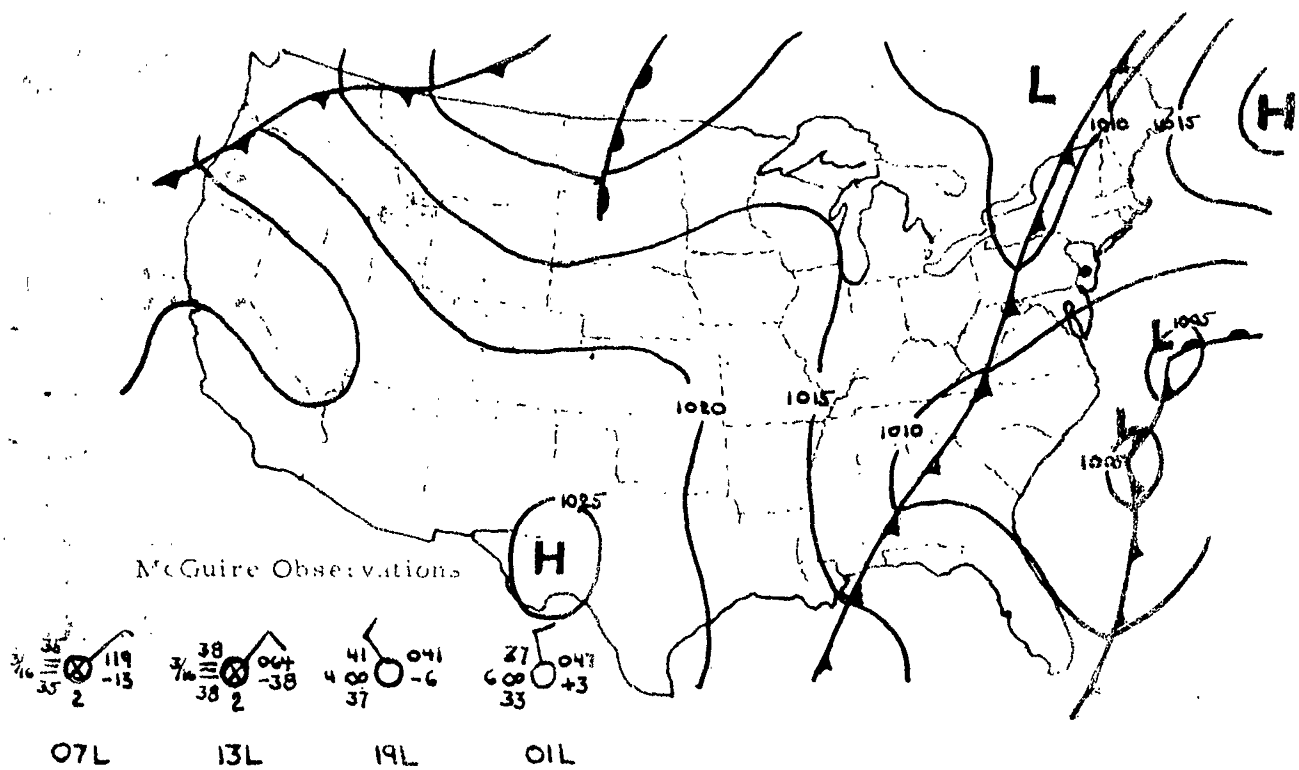
(9) CP Air Pushing South From Eastern Canada

(10) The "Northeaster"

WEATHER TYPE: GENTLE INFLOW OF MTW AIR - WEAK LOW TO SOUTH WITH STATIONARY HIGH TO THE NORTHEAST.

TYPICAL WEATHER CONDITIONS: Advection fog, light surface winds persisting until change of air mass occurs. This situation may cause prolonged periods of below minimum conditions since the air is very moist (note long overwater trajectory) and cooled by advection over cool coastal current with little or no turbulent mixing to raise the fog base.

EXAMPLE: SURFACE WEATHER CHART DTG 0700LST 1 MAR 59



OTHER SIGNIFICANT OBSERVATIONS: This situation set in on the morning of 27 FEB. when below min conditions set in at 0200L. It broke to clear at noon then went below at

REMARKS (SINGULARITIES, VARIATIONS, ETC.): 0300L on the 28th and again broke at noon.

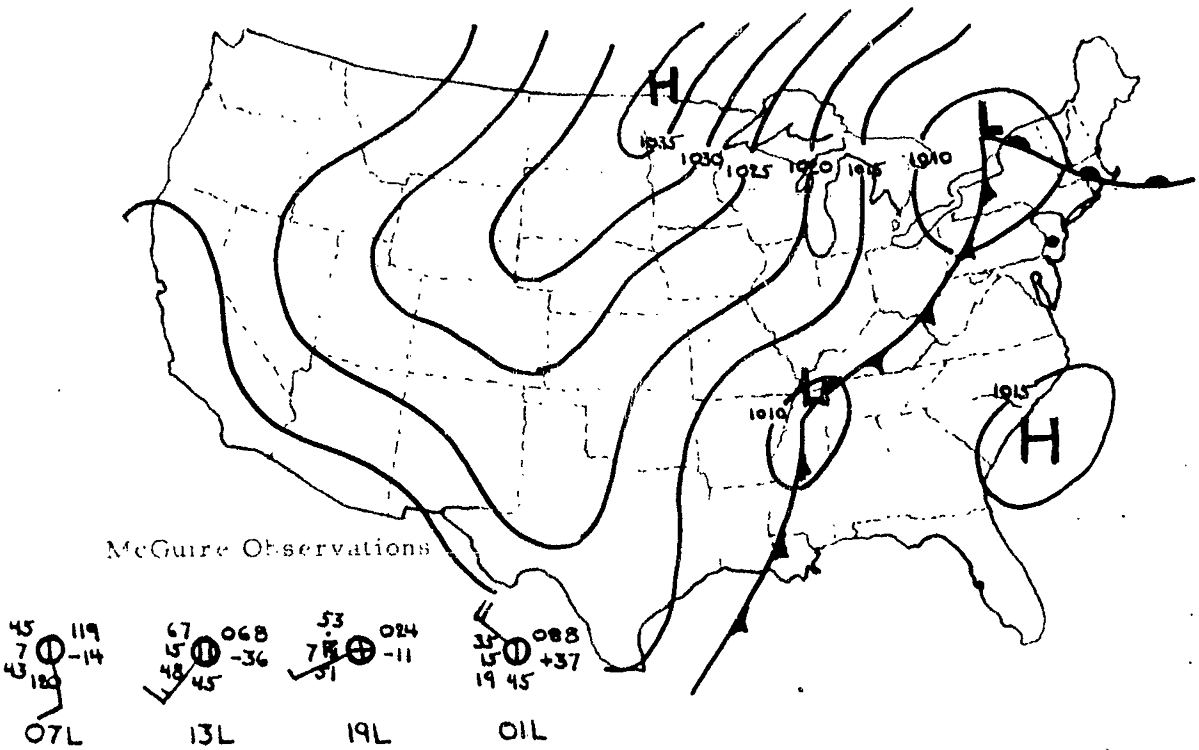
The advection fog was not associated with overrunning (or cloudiness aloft) thus diurnal heating caused the fog to lift (gradually in the morning) and break to CLEAR at noon on both the 27th and 28th of February.

Final clearing occurs with change of air mass.... usually CP pushing in from northwest.

WEATHER TYPE: INTENSE COLD FRONT APPROACHING MCGUIRE (MT AIR REPLACED BY CP)

TYPICAL WEATHER CONDITIONS: STRONG southwest surface winds, 4000ft broken clouds, fair to good visibilities except in showers ahead of front. Heavy showers ahead and in frontal zone. Rapid clearing with northwest winds behind front.

EXAMPLE: SURFACE WEATHER CHART DTG 0700LST 21 MAR 59



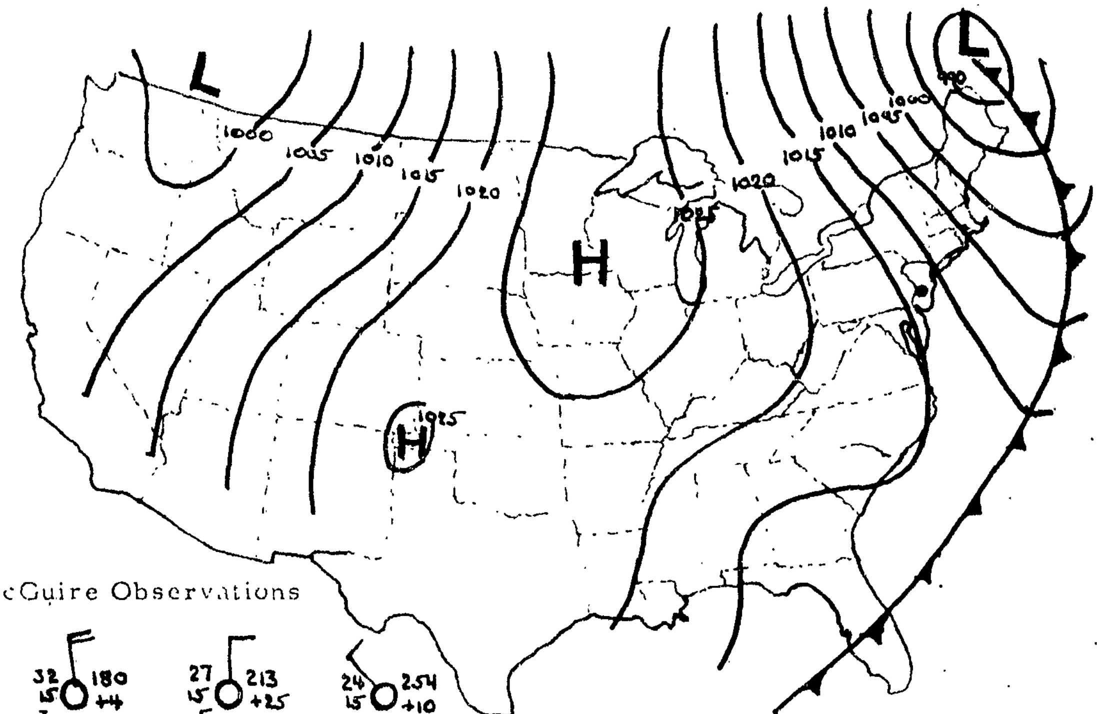
OTHER SIGNIFICANT OBSERVATIONS: Shower activity occured from 1700L until 2300L. Squall line passed at 1710L. Front passed at 2110L.

REMARKS (SINGULARITIES, VARIATIONS, ETC.). Squall lines frequently form ahead of such fronts and pass 3 to 5 hours before front. If the squall line is intense, the front is generally weak.

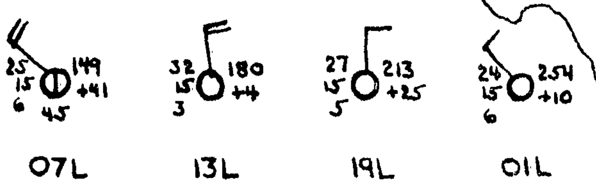
WEATHER TYPE: CPK OUTBREAK FROM THE NORTHWEST

TYPICAL WEATHER CONDITIONS: Clear, windy, excellent visibilities with low level moderate to severe turbulence. Moderate to severe CAT also likely in the associated jet stream. A common forecast pitfall in such situations is to assume surface winds will decrease throughout the day. But in spite of the tighter gradient to the northeast and the general easterly movement of the pressure systems, the diurnal effect usually compensates and causes the max winds to occur near noon.

EXAMPLE: SURFACE WEATHER CHART DTG 0700LST 22 MAR 59



McGuire Observations



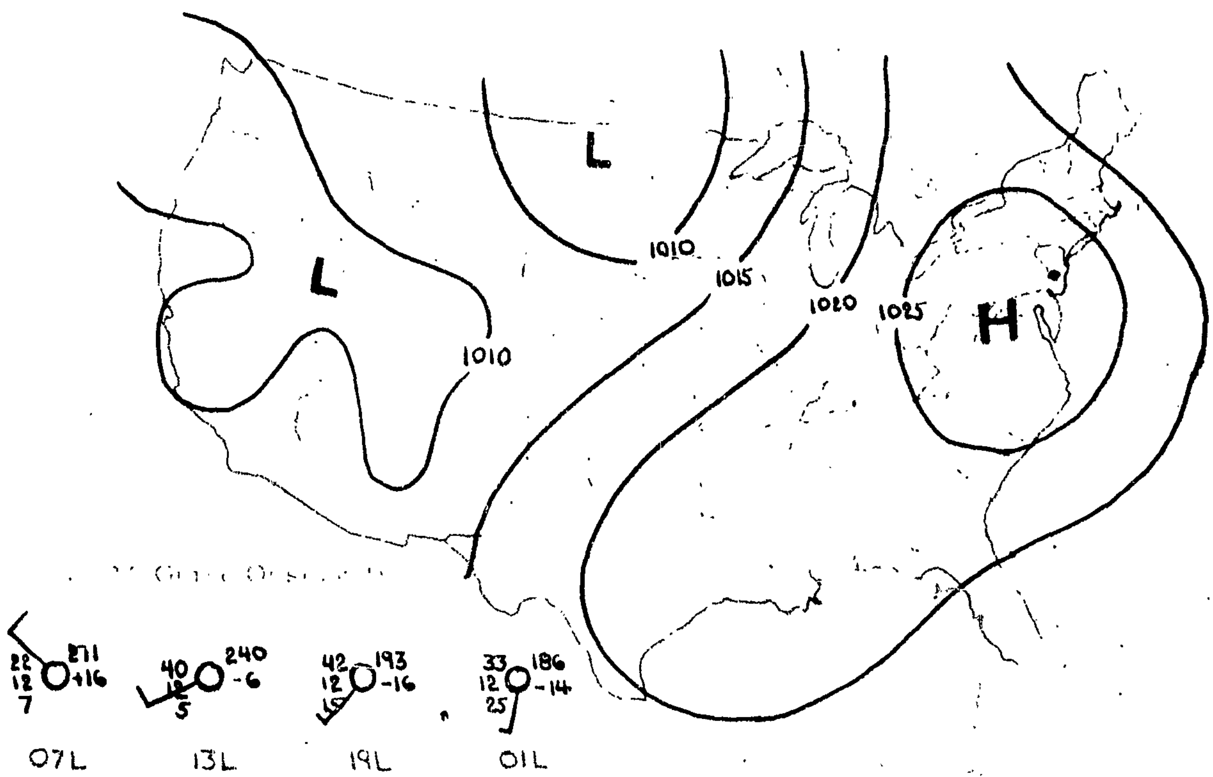
OTHER SIGNIFICANT OBSERVATIONS: Max gust WNW 32kts at 1132L

REMARKS (SINGULARITIES, VARIATIONS, ETC.): Broken cumulus (3-4000ft) and intermittent showers might occur if the flow is more cyclonic. (ie: If the major low is double centered with an axis along the St. Lawrence Valley.)

WEATHER TYPE: **CP HIGH MOVING OFF THE MIDDLE ATLANTIC STATES COAST**

TYPICAL WEATHER CONDITIONS: **Light northwesterly winds becoming variable then light (increasing) southwesterly. Visibilities good becoming slightly hazy. Clear skies with increasing high cloudiness and temperatures the following day.**

EXAMPLE: SURFACE WEATHER CHART FOR **0700LST 23 MAR 59**



OTHER SIGNIFICANT OBSERVATIONS: **High broken clouds at 24/0518L; 5 miles visibility in haze at 24/0700L**

REMARKS (SINGULARITIES, VARIATIONS, ETC.): **A fresh CP outbreak is not conducive to radiation fog, however radiation fog might be a problem if:**

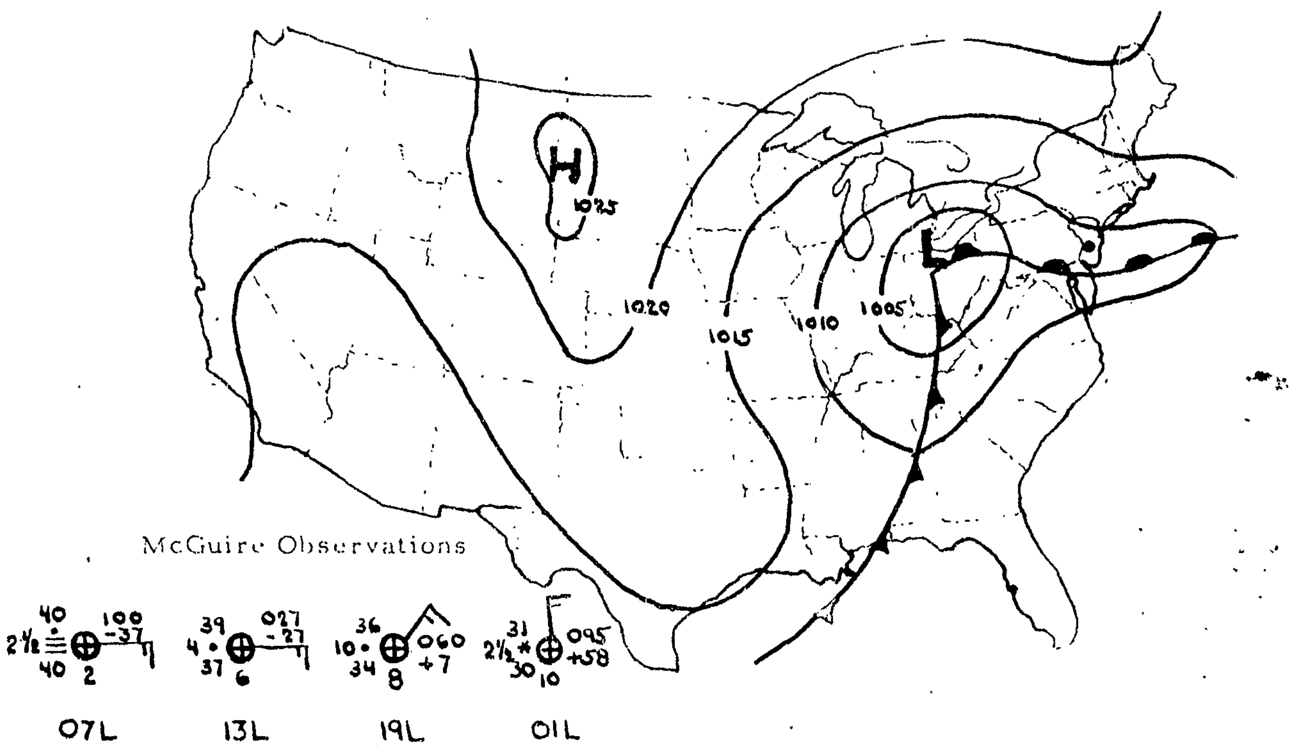
- **a. The high stagnates for 2 or 3 days**
- **b. The ground is wet and/or unusually cold**
- **c. The time of year is late spring.**

WEATHER TYPE: WARM FRONT SOUTH OF MCGUIRE WITH A WAVE TO THE WEST

TYPICAL WEATHER CONDITIONS: CP air (modified to MP by overwater trajectory); as air becomes more northerly it gradually becomes pure CP again.

Persistent low ceilings and visibilities and light continuous type precipitation that might last two or three days. Clearing will not occur until a well developed low forms, occludes and moves off the coast.

EXAMPLE: SURFACE WEATHER CHART DTG 0700LST 27 MAR 59



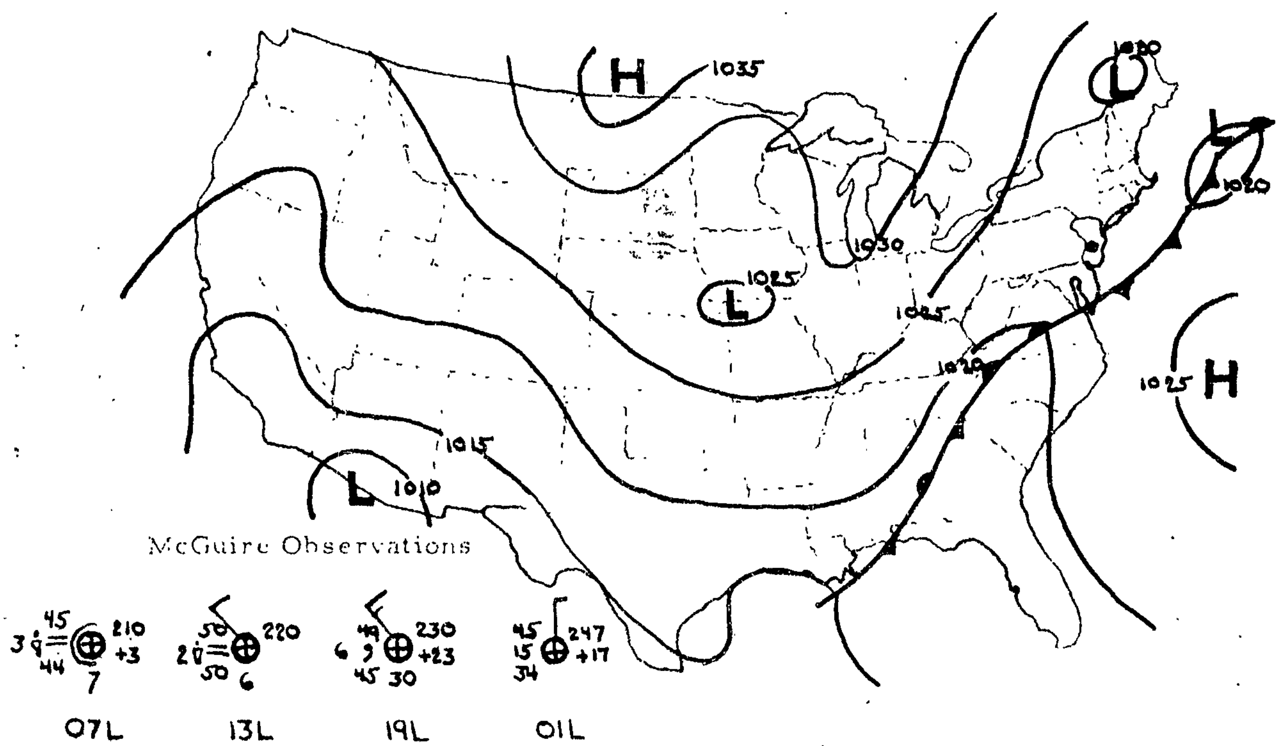
OTHER SIGNIFICANT OBSERVATIONS: After 28/0100L the ceiling continued to rise. Total sky cover was 2300 SCTD at 0813L and CLEAR at 1555L.

REMARKS (SINGULARITIES, VARIATIONS, ETC.): This system and resulting weather is typical of a developing wave center passing south of McGuire. In this case, the wind velocities were continually moderate and accordingly the visibilities were not extremely low.

WEATHER TYPE: **QUASI-STATIONARY FRONT TO THE SOUTH WITH MINOR STABLE WAVE ACTIVITY.**
(CP MODIFIED TO MP AIR WITH MT OVERRUNNING)

TYPICAL WEATHER CONDITIONS: **Multi-layered strataform clouds with periods of intermittent rain, drizzle and/or fog. (Fog caused by advection and precip evaporation) Ceilings and visibilities vary considerably with relative position of wave to McGuire or with surface wind direction.**

EXAMPLE: SURFACE WEATHER CHART DTG **0700LST 11 APR 59**



OTHER SIGNIFICANT OBSERVATIONS: **This condition existed for 4 days. During the entire period, skies were overcast but ceilings varied from 300ft to 9000ft.**

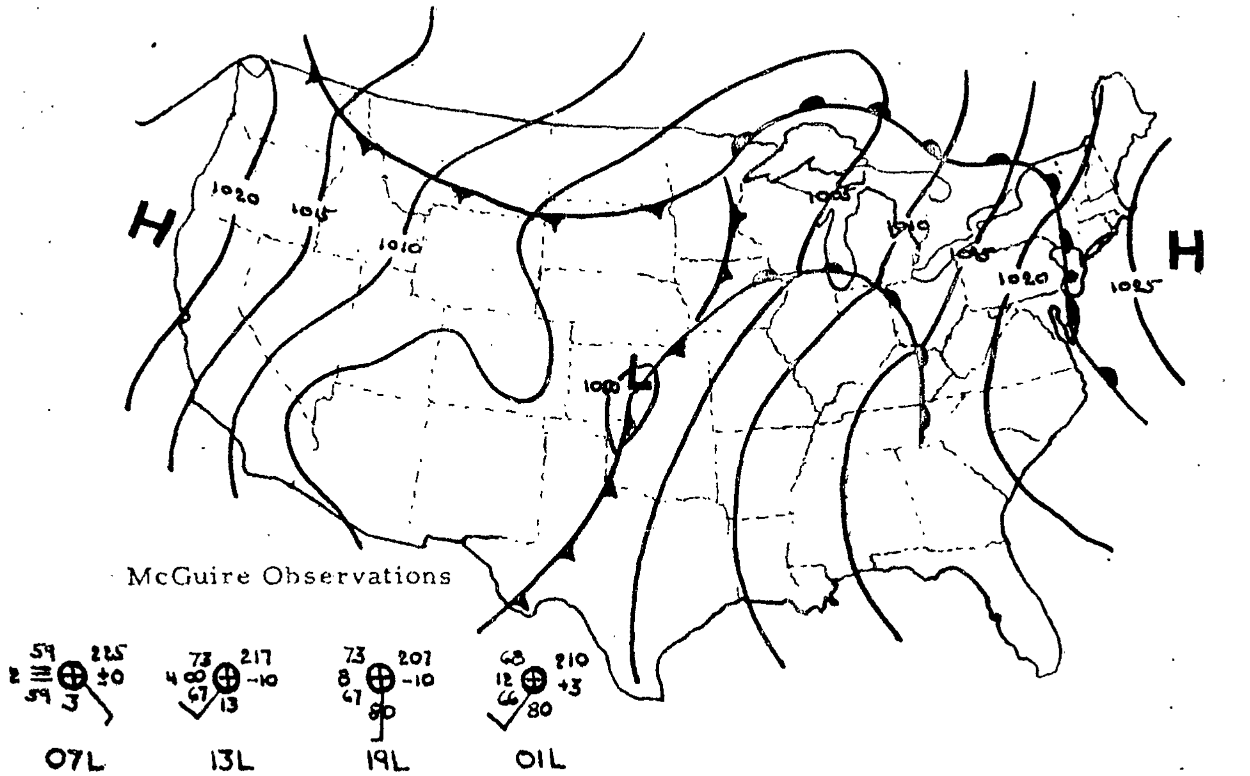
REMARKS (SINGULARITIES, VARIATIONS, ETC.): **Even after this type of regime sets in, the associated weather is difficult if not impossible to forecast more than a few hours in advance. Minor stable waves moving along the front will produce low ceilings and visibilities which will decrease with veering winds and increase with backing winds. Clearing results when the CP air forces the frontal system further to the southeast.**

Clearing might have been forecast with the above system by noting the 500MB trough which was very deep and located over the Dakotas. Although the front remained stationary, the trough aloft slowly moved eastward. Clearing occured when the trough became located along the Ohio-Alabama line.

WEATHER TYPE: **WARM FRONTAL PASSAGE FROM THE SOUTHWEST (MP REPLACED BY MT)**

TYPICAL WEATHER CONDITIONS: Middle and high clouds thickening and lowering with approach of front. Precipitation and or fog likely in frontal zone, Ceilings below 1000ft for about 6 hours prior and during passage. Middle cloud ceilings for about 12 hours after passage then clearing. Hazy conditions in warm air.

EXAMPLE: SURFACE WEATHER CHART DTG 0700LST 19 MAY 59



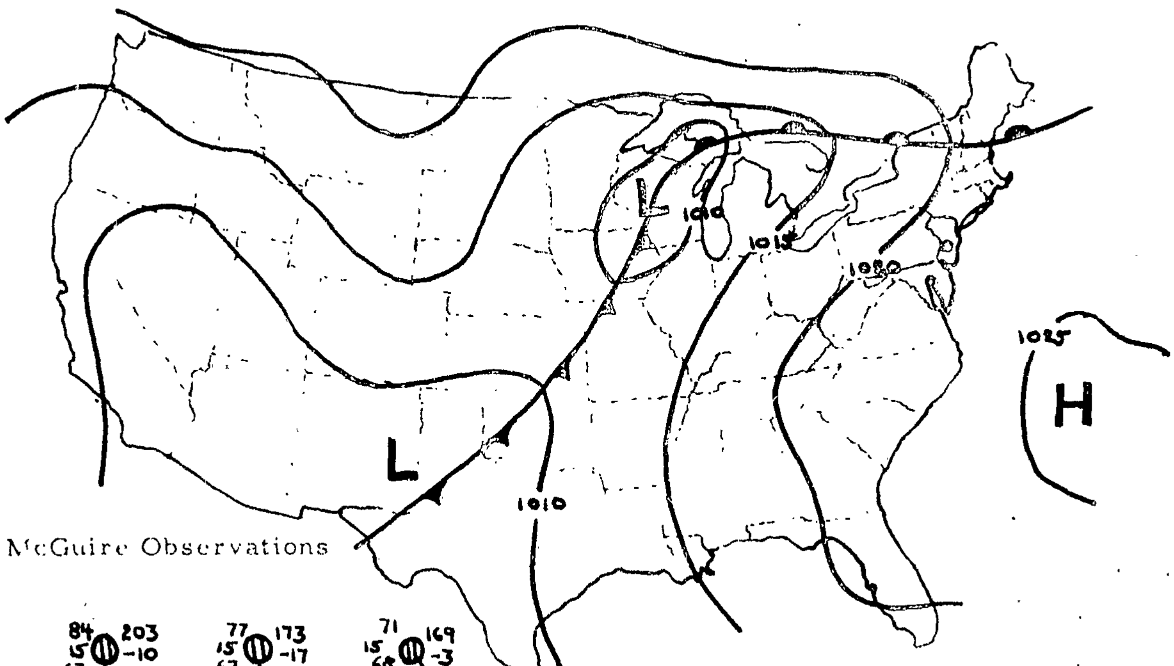
OTHER SIGNIFICANT OBSERVATIONS: Ceiling was 5500ft at 19/0100L and dropped to 700ft at 0540L. Front passed at 1200L and ceiling then lifted.

REMARKS (SINGULARITIES, VARIATIONS, ETC.): Example shown is a weak front.

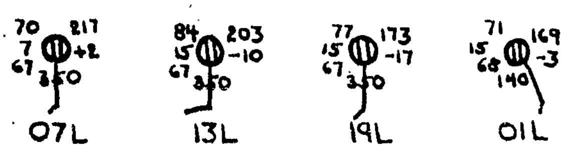
WEATHER TYPE: MT HIGH CENTERED OVER BERMUDA WITH SOUTHWEST FLOW OVER MCGUIRE

TYPICAL WEATHER CONDITIONS: Morning haze otherwise fair visibilities. Broken cirrus all day. Scattered variable to broken cumulus based 3000 to 4500ft during daylight hours.

EXAMPLE: SURFACE WEATHER CHART DTG 0700LST 21 MAY 59



McGuire Observations



OTHER SIGNIFICANT OBSERVATIONS: No showers or heavy build-up activity reported on this day (scattered to broken CU was reported). On the following day TCU was reported.

REMARKS (SINGULARITIES, VARIATIONS, ETC.).

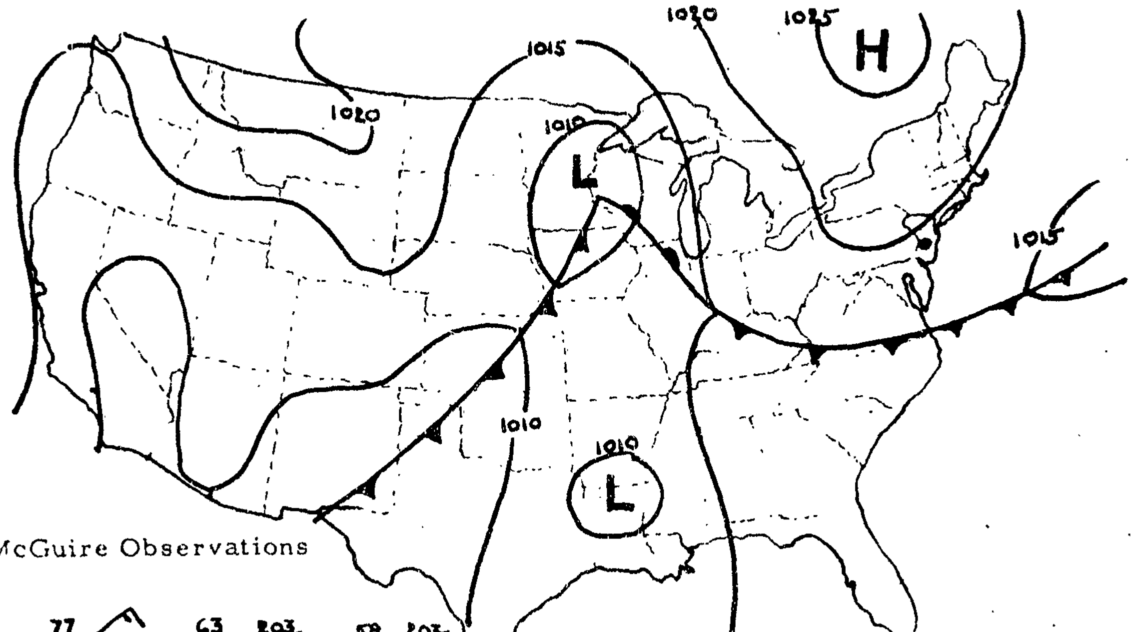
1. Each day this condition persists, cumulus activity increases.
2. If the flow becomes more southerly, stratus (6-1500ft) is likely to be advected during the night.
3. If the flow intensifies and becomes more westerly or westnorthwesterly, the additional adiabatic heating from the flow off the mountains results in the East Coast "Heat Wave" situation with temperatures reaching well above 90°.

WEATHER TYPE: CP AIR PUSHING SOUTH FROM EASTERN CANADA (BACKDOOR FRONT)

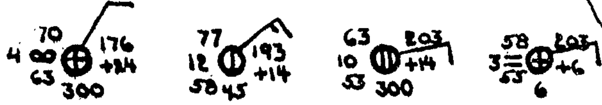
TYPICAL WEATHER CONDITIONS: WEATHER DURING THE FRONTAL PASSAGE DEPENDS primarily on the character of the MT air being displaced. In the northeast flow of CP air there are clear skies until a sufficient overwater trajectory has been established (about 12 hours). Then stratus based 6-800ft moves in. Stratus will persist as long as the flow remains easterly. With diurnal heating stratus may break by mid morning or if the layer is very thick it may persist all day lifting in the afternoon to 1500ft.

When forecasting the breaking time of stratus, the thinckness of the stratus is a very important parameter.

EXAMPLE: SURFACE WEATHER CHART DTG 0700LST 31 MAY 59



McGuire Observations



07L 13L 19L 01L

OTHER SIGNIFICANT OBSERVATIONS: A dry FROPA occured at 31/0300L marked by variable high and middle cloudiness 4 hours either side of passage. Stratus moved in at 2100L

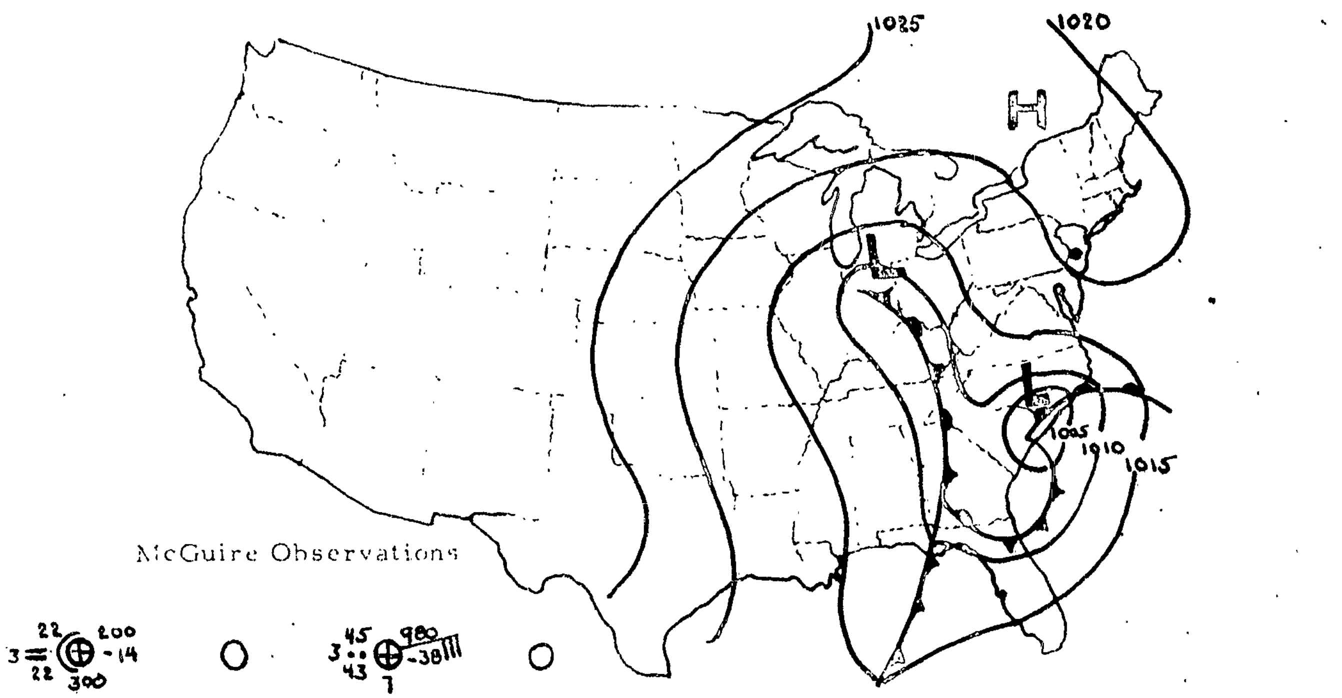
REMARKS (SINGULARITIES, VARIATIONS, ETC.): As with all CP outbreaks, fog is rare for the first 24 hours. After the stratus moved in, it remained (without breaking) until the wind shifted to northwest on 3 June. Field was below 200ft for 5 hours on the morning of 2 June.

WEATHER TYPE: **THE "NORTHEASTER"**

TYPICAL WEATHER CONDITIONS: **While the low center is still south of McGuire, typical warm front cloud conditions prevail: high cirrostratus lowering to 10,000ft altostratus. After light continuous precipitation starts, a stratocumulus deck forms in the precip based at 2-3000ft. A few hours after the rain, ceilings may drop suddenly to below 500ft. As the low deepens and moves northward, the easterly wind speeds might increase to 30kts (gusts to 40).**

In the example shown, (which is typical) the secondary low developed while the mother low filled. Both moved northeasterly. Double low centers such as in this example tend to keep cyclonic flow over McGuire after the low system moves off. The low center passed McGuire at 0700LST 12 Dec but skies remained overcast thru the 13th with periods of snow.

EXAMPLE: SURFACE WEATHER CHART DTG **0700LST 11 DEC 44**



07L 13L 19L 01L

OTHER SIGNIFICANT OBSERVATIONS: **Low center passed 24 hours later. Skies remained mostly overcast for 48 hours after passage with periods of snow showers reducing ceiling and visibility to 700ft and 3/4 mile**

REMARKS (SINGULARITIES, VARIATIONS, ETC.):

This situation may occur during any season but is most common in autumn, winter and early spring.

The "Northeaster" usually forms from one of two situations:

(1) A cold front moving off the coast stagnates and an unstable wave forms, deepens occludes and moves north toward Cape Cod.

(2) A weakening frontal system west of the Appalachian Mountains (as in above example) forms a secondary low along the Carolina Coast which deepens, occludes and moves nor[illegible]

C. EMPIRICAL RULES (INCLUDING: RULES OF THUMB, SHORT STUDIES AND ABSTRACTS OF STUDIES TOO LENGTHY TO INCLUDE IN THIS PUBLICATION).

1. TEMPERATURE
2. VISIBILITY
3. CEILING
4. PRECIPITATION
5. SURFACE WIND
6. THUNDERSTORMS
7. SYNOPTIC SYSTEMS

(1) TEMPERATURE

1. Many types of operations at McGuire are sensitive to temperature: take-off performance, outside maintenance, Fort Dix troop training, etc. Extreme temperatures recorded at McGuire are 101° (observed in July, August and September) and -4° (observed in February.)

a. Extreme high temperatures result from a persistent MT air mass that has obtained extensive additional heating by a long over-land trajectory with a "coup-de-grace" added by the downslope adiabatic heating as the air approaches McGuire from the west or west-northwest.

b. Extreme low temperatures result when strong advection of CP air lasts for two or more days and the wind drops off in the evening allowing additional radiational cooling to further reduce the surface temperatures.

2. Quick rules of thumb for temperature forecasts:

a. Minimum temperature forecasts: The minimum temperature for the following morning is forecast at time of maximum temperature. Three parameters are used: Maximum Temperature (T_x), Dew Point at time of Maximum Temperature (T_d), and cloud average cover expected over the period (N) in tenths.

$$\text{Minimum Temperature equal: } \frac{T_x + T_d}{2} - (10 - N)$$

b. <u>Maximum or minimum forecasts by relation to 850 MB temperature forecast.</u> This method requires the 850 MB temperature to be forecast for the period concerned then add the following values as indicated for the forecast in centigrade:

Max Summer Temperature: 850mb temp plus 15^{o} (assumes dry adiabatic rate)

Min Summer Temperature: 850mb temp plus 8^{o} (assumes moist adiabatic rate)

Max Winter Temperature: 850mb temp plus 8^{o} (assumes moist adiabatic rate)

Min Winter Temperature: 850mb temp plus 3^{o} (assumes stable adiabatic rate)

3. A pilot study was conducted at McGuire with the purpose of objectively forecasting the maximum temperature. Forecast was to be made at 0600L for the same day. The parameters tested included various combinations of temperatures, temperature trends, wind direction and velocities. No encouraging results were obtained except that the twenty-four maximum temperature change correlated best with the 24 hour wind vector change at 0600L.

4. One of the most complete references on max and min temperature forecasting is the USWB Forecasting Guide "Maximum and Minimum Temperature Forecasting" which summarizes numerous methods of forecasting these elements. A copy of this publication is filed in the detachment library (Manual #1).

(2) VISIBILITY

1. Visibility forecasts are very critical to flight operations. Once the visibility drops below 5 miles, almost every change that might occur is critical to one of the numerous flight activities operating at McGuire. Low visibilities may occur at any time of the year. The diurnal variation in visibility is very pronounced with lowest conditions occurring 75 minutes after sunrise. Visibilities improve rapidly on summer mornings and very slowly on winter mornings.

2. The objective visibility study for McGuire (See Part A) incorporates most of the obvious local parameters. (Note that it does not account for frontal passages and it often misses radiational type fog).

3. Low visibilities are closely correlated with low ceilings at McGuire. (77% of the time the ceiling is below 200 ft., the visibility is below 1/2 mile). Accordingly, rules that apply to low ceilings at McGuire can also be considered when forecasting visibility.

4. Relationship of dew point and sea water temperature:

    If dew point is above water temperature: FOG by sunrise.

    If dew point is 1-2 degrees below water temperature: STRATUS at 500 ft. by sunrise.

    If dew point is 3 or more degrees below water temperature: NO FOG OR STRATUS.

5. If an air mass stagnates over McGuire, visibilities will become progressively lower each day.

6. Regardless of other indicators (high humidity, etc), fog will not form over McGuire if a jet core is overhead.

(3) CEILINGS

1. All types of cloud cover as well as numerous ceiling limits are important to various flight operations at McGuire. The general statements concerning seasonal and diurnal visibility variations at McGuire are also true for ceilings.

2. A pilot study (currently being evaluated and expanded) utilizes two parameters observed at 0300Z to forecast the cloud condition between 1100Z and 1500Z (8 to 12 hours later). See Part A.

3. Rules for forecasting cloud cover:

a. If there are CU type clouds over WRI at 1000L the cloud layer will be broken by 1300L.

b. After a cold front passage: partly cloudy skies during the day, clear at nite regardless of shower activity over the Appalachians. If there is a closed low at 850 MB or 700 MB, there will be post frontal shower activity.

c. If the winds are in an easterly quadrant, the cloud cover will increase and the ceiling will lower (or remain constant) until the wind shifts to a westerly quadrant.

d. To forecast the amount (tenths) of CU or SC cloud: forecast the relative humidity at the surface and at 850 MB for the period concerned and use the average of these humidities in the following formula:

$$\text{TOTAL CLOUD COVER equal: } \frac{\text{Average RH}}{6} - 6$$

4. Height of CU or SC equal: $225(TT - T_dT_d)$. This formula is quite accurate if applied after the morning inversion or stable layer has broken.

5. <u>Relationship of cloud cover to upper air humidities:</u> A temperature dew point spread of 3 degrees or less indicates solid clouds; a spread of 4 - 8 degrees indicates broken clouds; a spread over 8 degrees indicates no clouds.

6. <u>Cirrus Forecasting:</u> A method utilizing 200mb or 300mb wind pattern and moisture values is contained in the "Objective Forecast Methods" manual retained in the detachment library. A comprehensive discussion of cirrus clouds as well as forecasting techniques is contained in 3WW Seminar #5 (Manual #5 in detachment library).

7. A general discussion of cloud forecasting is contained in 3WW Seminar #2 (Manual #5 in detachment library).

8. To forecast the break time of stratus or fog, the top (or thickness) of the stratus layer is most important. A rough approximation is that one hour of direct solar radiation is required for every 200 ft. of stratus.

9. Persistence probabilities computed for various times of day and various ceiling and visibility categories are filed in the McGuire climatological file.

(4) PRECIPITATION

1. The specific forecasting problems concerning precipitation are as follows:

   a. Begining - ending times.

   b. Type of precip (ie: Rain vs Snow, or Freezing Rain.)

   c. Amount or accumulation.

2. Methods of forecasting onset time: Method is explained in more detail in the "Objective Forecast Methods" Manual retained in the detachment library.

   a. Note time that the leading edge of middle clouds first appears in West Virginia.

   b. Determine the overall average 700mb flow component on the line to McGuire.

   c. Devide this speed into the distance (350nm) to determine the time increment to be added to time clouds first appeared over West Virginia.

   d. This method is most applicable to storms moving from the south west. Note that the onset time of precip at West Virginia is not a parameter.

3. Results of special investigation made of three severe snow storms that occurred during February and March of 1958:

   a. Two of the storms moved NE from the Gulf area, the other storm less severe (but resulted in 6 inches of snow) moved eastward from the Ohio Valley.

   b. Based on precip onset times of these storms, precip started at McGuire when the storm center passed the line: Willimington, N. C. - Pulaski, Va. - Akron, Ohio.

   c. Ceiling and visibility dropped abruptly from 6-8000' to 500' with onset of precipitation.

4. Rain vs Snow: Since the thickness pattern 1000 MB - 500 MB is usually available and a common forecast parameter, it is probably the best guide in determining rain or snow. Extensive studies at Idlewild have found this critical value to be 17,600 ft. Additional parameters are listed in table form below:

FORECASTED PARAMETER	SNOW	RAIN
Surface temperature at onset of precip:	35 or less	36 or above
850 MB TEMP over WRI	-3 or less	-2 or above
850 MB TEMP over DCA	0 or less	1 or above
1000 - 850 MB Thickness	4300 ft or less	4400 ft or above
1000 - 700 MB Thickness	9200 ft or less	9400 ft or above
1000 - 500 MB Thickness	17700 ft or less	17900 ft or above

Freezing Level 800 ft. or lower and cloud base above 4000 ft: forecast SNOW

Freezing Level above 2700 ft and cloud base below 2000 ft: forecast RAIN

5. The above rules are contained in worksheet form and maintained with verification results in the "Objective Forecast Methods Manual". An excellent reference for forecasting rain vs snow is the USWB Forecasting Guide #2 which is filed in the detachment library (Manual #3).

6. Precipitation Amounts: A quick method is to refer to the precipitable water forecast chart transmitted on facsimile. A forecast method (prepared by the USWB at Boston, Mass.) is abbreviated and revised for McGuire in the "Objective Forecast Methods Manual". The method utilizes the flow pattern at 850 MB and 700 MB. Local verification has proven the method to be quite accurate.

(5) SURFACE WINDS

1. Strong surface winds at McGuire are critical to certain ground functions as well as aircraft operations. There are three categories of synoptic situations which result in strong winds:

a. Tight westerly gradient--most common during the winter months reaching a maximum during March. March averages 21 days with gusts over 20 knots compared to 3 in July.

b. East Coast Storms (includes Hatteras type lows and tropical storms).

c. Gustiness associated with thunderstorms (although these create a significant hazard, the frequency is very low).

2. Quick rules of thumb for tight gradient type gusts:

a. If the surface wind is 10 knots one hour after sunrise, surface gusts will exceed 20 knots by noon.

b. Maximum gusts during the day will equal the prevailing wind velocities at 2000 ft. in the 200 mile western semicircle (as observed on the 0600Z winds aloft chart).

c. Due to terrain effects, easterly winds are not as gusty as westerly winds (note that due to less friction, easterly winds are more likely to approach gradient velocities than are the westerlies).

3. Rule of thumb for forecasting wind speed, gusts and direction: From the prog (this will generally be the 18 hr. NMC prog), steady wind equal 2/3 of the geostrophic, gust equal full value of the geostrophic, direction 30° across isobars.

4. Quick rules for thunderstorm gustiness.

a. Maximum gusts during thunderstorms equal to prevailing wind velocities at 5000 ft.

5. With a deep stagnant low near Newfoundland and a large high over central US, winds of 25-35 knots may last for a period of several days.

6. References: AWSM 105-37 explains a method for computing potential downdraft type surface gusts associated with thunderstorms. Two additional downdraft methods are explained in the local seminar file.

(6) THUNDERSTORMS

1. Thunderstorms favor forming in the mountains to the west but tend to dissipate and/or pass to the north of the station.

2. Squall lines when forming ahead of cold fronts pass McGuire 2 to 4 hours ahead of the front. If the squall line is strong, the front will be weak. Often clearing will occur behind the squall line and remain clear even during the frontal passage.

3. Thunderstorms are steered by the 700 mb flow moving at 75% of the 700 mb wind speeds. (50% of the 500 mb speed).

4. Thunderstorms will be severe if tops extend beyond tropopause.

5. The following synoptic considerations can be used to determine a probability of thunderstorms at McGuire. (use the probability weight additively).

SYNOPTIC CONDITION	WEIGHT PROBABILITY
a. Converging 700 mb isotherms in the area or moving into the area (100 naut. mi).	10%
b. Warm or stationary front to the South or Southwest.	10%
c. Greater than 50% rel. hum. or surrounding RAOBs with moist conditions extending above 500 mb.	10%
d. Low pressure over area.	10%
e. Passage of cold front or squall line in phase with time of maximum heating.	10%

SYNOPTIC CONDITION	PROBABILITY WEIGHT
f. Unstable lapse rates on surrounding RAOB's	10%
g. Cold 500mb trough over central USA and/or Canada.	20%
h. Cold front approaching from the west or north.	20%

(7) SYNOPTIC SYSTEMS

(1) CLOUDINESS:

a. In warm air mass moving cyclonically (or in a straight line) northward there will be abundant cloudiness and precipitation. If moving anticyclonically... no clouds.

b. Air moving from the north in a straight line (or anticyclonically) results in clear skies.

c. Elongated V-shaped trough aloft... clouds and precip in southerly flow; clearing at and behind trough.

d. Air masses in an anticyclonic moving path are more stable than those moving in a cyclonic path.

(2) MOVEMENT OF UPPER AIR TROUGH OR RIDGES:

If contours and Isotherms are -

a. In phase and parallel ... stationary

b. In phase but isotherms of less amplitude... retrograde

c. In phase but isotherms of greater amplitude... slow moving

d. 90° out of phase... move with gradient wind.

e. 180° out of phase (temp trough over contour ridge, etc)... fast moving.

(3) MOVEMENT OF SURFACE LOWS:

a. Direction of warm sector isobars

b. Toward 3-hour pressure falls

c. Direction of jet max (not with speed)

d. Along thickness lines

e. With direction of winds aloft at lowest level that is not closed.

f. Along front (if front is stationary or nearly so)

g. Cold lows move at the speed of upper low.

h. If low does not extend to 500mb. . . moves with 50% of 500mb wind speeds.

i. Move with speed of warm front and slightly slower than cold front.

j. Move toward areas where wind speed are <u>sub</u> normal.

(4) <u>FILLING OF LOWS:</u>

a. When only warm air advection is present or if cold air advection ahead of wave.

b. With advection of anticyclonic vorticity.

c. Pressure rises ahead of low.

d. If upper trough weakens.

e. If moving into a major ridge aloft.

f. Moving toward higher thickness values.

g. Low deviates to right of normal track.

(5) <u>DEEPENING OF LOWS.</u>

a. Cold air advection in cold sector.

b. Advection of cyclonic vorticity.

c. Pressure falls behind low.

d. Upper trough intensifiction.

e. Moves toward lower thickness.

f. Low deviates to left of normal track.

(6) FRONTS:

a. Will intensify if 700mb flow is parallel to cold front. (Weaken if perpendicular)

b. Precip and clouds will extend as far behind cold front as 700mb winds are parallel.

c. Precip and clouds where 700mb winds flow across warm front and turn cyclonically. (No weather or clouds if flow is anti-cyclonic).

d. A change in the type of advection behind a slow moving cold front is a sign of wave developement.

e. With a low north of Chicago and a cold front extending from it to near the gulf of Mexico, the front will pass Washington within 24 hours if the pressure difference is 9mb or more between the Gulf and CHI. It will not pass within 24 hours if less than 9mb.

(7) BLOCKS:

a. Most common in eastern part of oceans.

b. Intensify with warm advection on west side ... weaken with cold.

c. Intensify with westward movement. . . . weaken with easterly.

d. Intensify with SE jet.

(8) FORMATION OF FRONTAL WAVES:

a. Waves develope on slow moving fronts of strong thermal contrast when flow is parallel to front.

b. Develope in regions of cyclonic vorticity advection.

c. Develope in areas where pressure falls occur behind front.

(9) HIGHS:

a. Warm highs move with with speed of upper ridge.

b. Cold highs are steered by jet.

c. Cold highs moving south weaken.

(10) THE JET STREAM:

a. Direction and speed of max wind center... same as flow at 700mb.

b. Max center moves along progged 500mb contours.

c. Max will intensify if surface low deepens.

d. Will intensify if temperature gradient at 500mb is tightening.

e. Middle latitude jet will normally be above the front at 500mb (and along the 18,200 contour)... or about 300 miles behind the surface front.

f. Average shear near core.... 1 Knot per NM on cold side; 1 Knot per 3 NM on warm side.

g. Generally located north of an open wave and south of an occlusion.

h. Will flow parallel to warm sector isobars or flow on north side of a warm high.

(11) CAT: A folder is maintained in the detachment library which contains numerous publications and forecast techniques regarding CAT. The forecast technique listed here is abbreviated from the method used by the USWB Idlewild Forecast Center.

Location: CAT is generally located 60 NM either side of the jet and will be 10,000 ft. thick. The base will be at 29,000' if jet is above 300 mb or 24,000' if jet is below 300 mb.

Intensity: Consider a point of interest, determine the five forecast parameters, add the five scores from the Forecast Parameter Tables and read the intensity forecast from the Intensity Forecast Table.

FORECAST PARAMETER TABLES

VERTICAL SHEAR (KTS/1000' between 3-500mb)

over 5	3
4 - 5	2
2 - 3	1

HORIZONTAL SHEAR (KTS/Degree Lat)

over 59	3
40 - 59	2
20 - 39	1
0 - 19	0

300 MB JET POSITION

Exit Area	3
Entrance	2
Exit	1
No Jet	0

INTENSITY FORECAST TABLE

TOTAL SCORE	INTENSITY
13	Severe
12	
11	
10	Moderate
9	Occnl Severe
8	
7	Moderate
6	
5	Light Occnl
4	Moderate
3	
2	None or
1	Light
0	

CURVATURE

Anti-cylonic	2
Cyclonic	1
Straight	0

JET SPEED (at 300mb)

over 79	2
Less than 80	1
No jet	0